

National Aeronautics and
Space Administrator

Productivity Improvement and Quality Enhancement 1985 Accomplishments Report

(NASA-TM-89351) NASA PRODUCTIVITY
IMPROVEMENT AND QUALITY ENHANCEMENT PROGRAM:
1985 ACCOMPLISHMENTS REPORT (NASA) 65 p

N90-71399

00/81 0064871
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NASA IS:

- **22,000 Civil Servants**
- **133,000 Contractor Employees**
- **Over \$14 Billion In Land, Buildings Equipment and Supplies**
- **Washington D.C. Headquarters and Nine Installations Nationwide**

1. Ames Research Center

Moffett Field, California

2. Goddard Space Flight Center

Greenbelt, Maryland

3. Jet Propulsion Laboratory

Pasadena, California

4. Johnson Space Center

Houston, Texas

5. Kennedy Space Center

Florida

6. Langley Research Center

Hampton, Virginia

7. Lewis Research Center

Cleveland, Ohio

8. Marshall Space Flight Center

Alabama

9. National Space Technology Laboratories

Mississippi

NASA
PRODUCTIVITY
IMPROVEMENT
and
QUALITY
ENHANCEMENT
PROGRAM

1985 ACCOMPLISHMENTS REPORT

DECEMBER 1985

FOREWORD

Our Nation is at a critical crossroads. As we respond to budget pressures at home and increasingly competitive trade from abroad, we must make decisions that will affect the Nation's future economic growth and the standard of living of every American. As an agency of the Federal Government, NASA has sought to meet every technical challenge that it has encountered. Now we must resolve our technical challenges with a level of productivity never before achieved. Landing on the moon, flying the space shuttle, and exploring the outer reaches of our solar system are clearly achievements in which we can take pride. NASA's management techniques and practices are an equally important contribution to the Nation.

NASA retains its sense of commitment to scientific research and the development of new technology. Other Federal agencies have shown interest in our efforts, and we try to work with them at every opportunity. Since about 85 percent of NASA's budget is with outside contractors, our relationship with those who provide us products and services is crucial. This report shows how NASA promotes a spirit of cooperation and teamwork in forging a strong link with contractors. It remains NASA's belief that working with the private sector yields rich rewards to the Nation by obtaining the most for the taxpayer's dollar while maintaining the highest levels of quality.

A handwritten signature in cursive script that reads "William R. Graham".

William R. Graham
Acting Administrator

PREFACE

This report is written primarily as an internal document for exchanging ideas across the Agency. It is organized along the themes developed in the 1984 National Symposium on Quality and Productivity, "Framework for Action," which is endorsed by the NASA Administrator. With the issuance of this third annual report of NASA accomplishments in productivity and quality enhancements, we find a considerable growth in productivity activities throughout NASA and its contractor organization. Indeed, these activities were so numerous, that it was decided to issue a summary report which only highlighted accomplishments.

You will note considerable progress throughout the Agency. Each NASA installation has developed a formal productivity and quality improvement plan. Our contractors have made productivity improvement an explicit objective, and many have formal programs. During 1985, our Employee Suggestion Program had three times the number of suggestions as in 1983, and in 1985 our NASA Employee Teams (Quality Circles) numbered almost 180 across the Agency. That translates to approximately seven percent of NASA employees making suggestions for improvement, and approximately nine percent of our employees working in teams on problems to improve NASA's way of doing business. This year NASA has also taken the unprecedented step of eliminating 15 percent of its Management Instructions to further streamline management and to encourage greater delegation. And you will note that NASA is also making progress in developing measures of productivity growth in administration, and research and development.

NASA can take pride in its accomplishments in productivity and quality improvements. We have taken significant strides in making continued improvement a philosophy to be shared by all NASA employees and contractors. We look forward to 1986 with great anticipation.



David R. Braunstein
Director, NASA Productivity Programs

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I. INVOLVE TOP MANAGEMENT TO PROVIDE LEADERSHIP AND DIRECTION

Ames Research Center (ARC)

Center Director Initiatives. The Center Director spends over a hundred hours per year to keep the resident staff up-to-date on the organization's goals and objectives and to receive their suggestions and opinions. He also delivers an annual address to the entire Center in which he describes the goals, accomplishments, and future outlook for the Agency and the Center. On a more personal level, he hosts an informal monthly luncheon with approximately 15 randomly selected individuals from the various directorates to exchange views on issues and concerns at the Center.

Center Awareness Meetings. The first meeting dealt with the Director's performance plan, and how division chiefs could help in implementing the plan. Additionally, the meetings of the strategic review teams provide an avenue for heightening employee knowledge and awareness. Four facility teams and eleven major program teams were formed from predominantly non-supervisory people. Each team's charter is to create a vision of the future for their area of concern, and to develop alternative strategies to reach that vision. The Director and the Center Board of Directors hold periodic meetings with leaders of the strategic review teams to monitor progress and to encourage innovative approaches.

Johnson Space Center (JSC)

R&D Conference. Recognizing that increasing productivity awareness at all levels of the organization is an essential element in achieving significant productivity improvement, JSC continues to support activities for managers as well as employees. The key activity for managers during 1985 was an R&D Productivity Conference that provided a forum for middle managers to share current state-of-the-art productivity techniques and ideas.

Approximately 500 managers from NASA and NASA contractor organizations attended the R&D Conference. Held September 10-11, the conference offered 18 topics including: Designing Space Station for Productivity, Productivity Tools in Shuttle Mission Operations, Multi-Organizational Cooperation, R&D Productivity Assessment, Improving Engineering Effectiveness, Building Employee Involvement, and Increasing Employee Participation.

Langley Research Center (LaRC)

Quality Circle Awareness Program. On July 19, 1985, a Quality Circle Awareness Program was held with representatives from all Quality Circles and their respective line managers. The Center Director and Director for Systems Engineering and Operations addressed the group and status reports were presented by many quality circles.

Annual State-of-the-Center Address. On July 31 and August 1, 1985, The Center Director gave the Annual State-of-the-Center Address. Special emphasis was placed on productivity improvement and removal of impediments.

Marshall Space Flight Center (MSFC)

MSFC Steering Council. The MSFC Productivity Steering Council, composed of all Directorate Heads and Project Office Managers and chaired by the Executive Assistant to the Center Director, meets monthly to provide overall guidance to the MSFC Productivity Improvement and Quality Enhancement (PIQE) Program. During 1985, the

head of each organizational unit of the Center reported on the PIQE activities being emphasized within his organization. This cross-fertilization of ideas was most beneficial to all members of the Council.

Goals and Objectives. Agency Goals and Objectives were transmitted throughout the Center. Each organizational level through the branch level then established their own Goals and Objectives in support of those of its parent organization. Progress against these Goals and Objectives is reported on a semi-annual basis with results used in part to measure organizational performance.

National Space Technology Laboratories (NSTL)

Commitment to Excellence. The NSTL Director published a Commitment to Excellence establishing six goals for the NSTL which will contribute to the attainment of the overall Agency objectives. The Director challenged each member of the NSTL government/contractor team to establish objectives to attain the NSTL and Agency goals, and called for a rededication and commitment in striving for excellence in each of their endeavors.

PIQE Panel. The PIQE Panel meets periodically to review Productivity Improvement efforts and to evaluate results at the NSTL. There are five NASA panel members and six contractor advisors. Through the panel, awareness of other NASA centers or industrial productivity improvement activities are made available to all organizations.

Headquarters

Establishment of Office of NASA Productivity Programs (Code A). On April 5, 1985 NASA Management Instruction (NMI 1270.1) was published which established the office of NASA Productivity Programs as a permanent organization within the Administrator's office. The office of NASA Productivity Programs is responsible for the direction, initiation, coordination, monitoring, and evaluation of the agency-wide productivity improvement and quality enhancement initiatives.

Senior Executive Meetings (Code A). As part of NASA's effort to involve top leadership in the productivity program, three meetings of senior staff were held in 1985 that were devoted exclusively to productivity and quality improvement issues. In January and October, the Productivity Steering Committee met to review productivity efforts and to discuss plans for the future. The Committee is chaired by the Administrator, and includes Associate Administrators and Center Directors as members. The January meeting focussed on agency productivity and quality issues. At the October meeting the group was hosted by the Merck, Sharpe & Dohme pharmaceutical company of Rahway, New Jersey. There, the agenda included presentations from senior company officials concerning Merck's successful productivity program. The third meeting of the year involved NASA Deputies (Deputy Associate Administrators and Deputy Center Directors). This gathering was similar in style and format to the earlier two meetings and was held in November at the headquarters of the Honeywell Corporation in Minneapolis. Honeywell's innovative approaches to productivity improvement were presented to the NASA group. In total, these three meetings of senior NASA officials have proved to be a most effective means of engendering top management support for improving productivity and quality at NASA.

Second Annual NASA Contractors' Conference (Code A). In June 1985 NASA sponsored its Second Annual Contractors Conference at Marshall Space Flight Center (Hardware Contractors) and at Kennedy Space Center (Support Service Contractors). In all, more

than 120 contractors and representatives from every NASA installation attended the sessions for a total of more than 320 people.

The conferences were composed of panels representing organizations taking an active interest in formalizing the process to improve quality and productivity. Panel presentations focused on themes such as "Productivity and Quality Initiatives," "Participative Management and Middle Management," and "Incentives for Productivity and Quality."

Government Quality Conference (Code A). On October 29, NASA and other interested federal departments and agencies (Defense, Labor, General Accounting Office, Office of Management and Budget and Office of Personnel Management) sponsored a one-day Government Quality Conference to help set the stage for leadership in achieving the new Presidential initiative to increase government performance through high quality service and increased agency productivity. More than 200 executives from 30 agencies and the Congress attended the unique session. The session was tailored to be of maximum interest to top level civil servants and Administration appointees. The Director, NASA Productivity Programs chaired the conference.

Symposium on Automation, Robotics and Advanced Computing for the National Space Program - September 4-6, 1985, Washington DC (Code D). Office of Chief Engineer planned and organized the symposium, with the assistance of the American Institute of Aeronautics and Astronautics (AIAA) and the Defense Advanced Research and Projects Agency (DARPA). Code D representatives served as General Chairman and Program Chairman of the symposium, respectively.

The symposium was organized as a response to the congressional mandate for NASA to devote a significant amount of Space Station funds to automation and robotics (A&R), and to emphasize the importance of A&R and advanced computing to the entire Space Station community.

Another objective of the symposium was to provide a forum for government, university, and industry executives and researchers to discuss and exchange information on the need for, and the desirability of different approaches to, adopting A&R and various forms of advanced computing in the space program.

The symposium was planned for 300 government, university, and industry executives. The actual attendance amounted to approximately 800, with nearly 150 NASA employees participating. By every measure, the symposium was a success with many applications of A&R in NASA, DARPA, other government agencies, universities, and industry being presented. In addition, unique approaches to the education and training of NASA employees in the disciplines of A&R, expert systems, and other forms of advanced computing were presented.

The symposium proved very timely for the Agency interests in A&R and served as a useful forum to articulate NASA program plans. The symposium brought together persons who are fully knowledgeable in current thinking on A&R and advanced computing; those who are interested and involved in its applications or policy implications; and those who are interested in research opportunities in these emerging areas.

2. SET TEAM GOALS THAT PROMOTE WORLD CLASS LEVELS OF QUALITY

Ames Research Center (ARC)

SOFTLIB. Most programming services at Ames are performed under a large cost plus award fee support-service contract. This contract provides for the services of 200 professionals. In addition to the cost of the services, the Ames requestors are surcharged another two percent for software management - specifically to keep abreast of new technology and to increase programmer productivity. One of the achievements of that software management program was to develop a central on-line library, SOFTLIB, in order to reuse any existing program. Every programmer must search the library for reusable code before starting the design of new programs. To perpetuate the value of SOFTLIB, the contractor is constantly evaluated, using an award fee criterion, on their efforts to improve the use of sharable code, e.g., the number of new entries added to SOFTLIB per month. At the present time, SOFTLIB contains several hundred entries containing thousands of programs. Last year Ames documented savings of over \$1,000,000 from the use of SOFTLIB.

Productivity Orientation Seminar (POS). The ability to identify impediments and opportunities for greater productivity is not always evident, and can be developed or encouraged through training courses such as the Productivity Orientation Seminar (POS). Within the last year, Ames has initiated a series of POSs. Rather than following the Headquarters-developed POS, Code E appointed a committee to tailor the Headquarters-developed POS for their peculiar problems. The Center Director opened the seminar with a challenge to 39 Code E managers to improve their capabilities and productivity by "working strategically and working smarter." The emphases of the seminar were: (1) to assess the strengths and weaknesses of Code E and to identify the impediments to productivity, and (2) to develop ideas and tools for increasing productivity. At the conclusion of the seminar, each organizational unit of Code E was asked to discuss and commit to an immediate implementation of at least one new productivity initiative.

Goddard Space Flight Center (GSFC)

Contractor Consolidation of Support Functions. The contractor support for the Solar Pointing Sounding Rocket Payloads is now consolidated at White Sands Missile Range (WSMR), a low overhead location. Earlier missions were supported by Lockheed from two sites: Sunnyvale, California (high overhead) and WSMR. The consolidation reduces overhead and manpower, resulting in a savings of over \$500,000 per year.

NIMBUS 7 Backup System. The newly introduced Nimbus 7 Backup System (BUS) is an innovative GSFC/Contractor effort. The flexibility and reliability BUS system software have eliminated the need for three computer systems in the Meteorological Operational Control Center (MetOCC). The savings in operational costs and related tape requirements is approximately \$400,000. In addition, contractor data production costs (actual) are 15% below estimates based upon previous contract costs for similar work.

Flight Tape Recorder Purchase. The Upper Atmosphere Research Satellite (UARS) Program Office benefited from advance procurement planning. A savings of at least \$100,000 resulted from combining the UARS tape recorder order with NOAA and COBE (Cosmic Background Explorer) tape recorder orders.

Use of Spare and Captured Hardware. Authorization for Upper Atmosphere Research Satellite (UARS) program planning and costing to assume the use of Multi-Modular Spacecraft (MMS) spare hardware resulted in a saving of approximately \$40M. In addition, the attitude control system module from the in-orbit repair of the captured Solar Maximum Satellite was returned to Earth, refurbished and allocated to the UARS Program inventory.

Software Development. The Land Analysis System (LAS) and the Atmospheric and Oceanographic Information Processing System (AOIPS) are two recently completed software systems which improve productivity for land scientists and meteorologists, respectively. Each system responds to a single command structure and eliminates the need for users to reinvent an optimized analysis program for each new research project. In addition, programming to develop new systems has been greatly reduced by the Transportable Applications Executive (TAE) software which does only once all major repetitive steps in applications programs.

Automated Submittal of Objectives and Plans. In 1985, the annual preparation and submittal of the Center's Research and Technology Operating Plan (RTOP), was done for the first time by means of a completely automated process. Using a series of diverse work stations, GSFC staff were able to transfer data electronically to headquarters. This successful initiative fulfilled a major 1985 agency productivity goal. It represents significant savings in time and materials as well as enhanced product quality.

Satellite Data Relay Link Across Antarctica. A team of GSFC engineers and scientists planned, developed, and executed a method to eliminate the traditional time-consuming and weather-dependent process of aerially transporting accumulated scientific data from the South Pole to the U.S. The successful one-year project used excessed ground equipment, then modified it for the polar region, and ingeniously linked polar orbiting satellites with geosynchronous satellites, thus increasing the productivity of scientific data collection in Antarctica. The resultant data link provided daily, error-free, near real-time transmissions without affecting the normal operations of the five satellites employed to serve as South Pole communication relay stations. The scientific community, worldwide, is benefiting from timely research data.

Satellite Servicing. Management of the use and reuse of Agency investments in orbiting flight systems encompasses replaceable modules, supportive equipment, fixtures, tools, software, documentation and common spares. Servicing and repair responsibility for certain satellites has been assigned to a newly created organization called the Satellite Servicing Project. Satellites utilizing multi-mission modules will be prime beneficiaries. These include the Solar Maximum Satellite, the Landsat series, the Upper Atmosphere Research Satellite (UARS) and the Gamma Ray Observatory (GRO). Servicing or repair of orbiting spacecraft can extend usable lifetimes. Refurbishment in-orbit can revise or upgrade mission capabilities. Retrieval allows ground-based replacement of instruments to pursue new missions.

Jet Propulsion Laboratory (JPL)

Venus Radar Mapper Performance Measurement System. Financial Planning personnel working on the Venus Radar Mapper Project have improved the PMS reports used to monitor two major subcontracts. The new approach includes the use of an IBM PC XT, a Epson FX-185 dot matrix printer, and Lotus 123 software. Major portions of these reports were previously generated using a costly leased terminal and time sharing service in another building. After 14 oversized plots for each subcontract were completed at

this terminal, the data points were then connected by manually drawing in the lines each month. These large sheets required reduction by a reproduction facility in another building and took approximately three days to reproduce.

The new approach, using a graph and a table on the same page, includes more information than was previously generated. The computer is located in the user's office and changes can easily be made without manual work. The reports are entirely generated and reproduced without leaving the building. Now the reproduction process for both of the 40-page subcontractor reports requires only an hour and distribution can be made the same day. In addition to the savings in time and cost for the production of the report, the appearance is more professional.

Research Technology Operating Plan (RTOP) Automation Project. The entire Code R RTOP submittals for FY 1986 were made on magnetic tape rather than the normal hard copy. At the same time, the Code R RTOP code structure and RTOP format were completely revised. These actions resulted in several benefits to JPL and NASA: The number of people involved in preparing the RTOPs was reduced; the number of RTOPs was reduced from 50 to 10; and the requirement to send six copies of each RTOP to NASA was eliminated.

Productivity Improvements in the Financial and Property Management Division. The Contract Audit Group in the Accounting Section has implemented a computer program to enter monthly unpaid and unbilled cost data. In the past, the multi-account distribution was manually recorded on worksheets and then keypunched by the Administrative Computing Section for inclusion in the JPL financial records and reports. A great deal of duplication of effort is avoided since approximately 2,241 records a month now bypass the key-punch process. In addition, recurring data (non-blanket purchase order, contract and account numbers, and amounts) are stored in the database and do not require a repetitive manual handling process.

Johnson Space Center (JSC)

Streamlining Orbiter Support. Major efforts have been made to streamline Orbiter support to reduce flight turnaround time, reduce costs, and enhance project management. These include: the establishment of an Orbiter Equipment and Repair Service Center at KSC to reduce costs associated with spares inventories, on-call repairs and service, and repair turnaround time; modified engineering design systems associated with the Orbiter vehicle and the Orbiter Maneuvering Systems pods to accommodate changing mission/cargo/vehicle assignments and other project variations with minor drawing revisions; and a 2-year phased transfer of vehicle and GSE (Ground Support Equipment) sustaining engineering and logistics from JSC to KSC to permit more direct and timely management to support operational needs.

Cost Reduction in Flight Clothing. A significant reduction in the cost of flight clothing for Orbiter flightcrews was made possible by changing to mass-produced, standard military-sized uniforms. Flight clothing had been constructed on an individual basis by a firm specializing in protective clothing. Compared to that approach, the new contract has reduced cost more than \$500,000. In addition, early delivery of clothing will allow a large inventory to be maintained so that crew members can be fitted with a minimum of special tailoring.

Kennedy Space Center (KSC)

Deionized Water Plant. Past practice used in performing neutralization of the process plants' waste water has been for the plant operator to request a laboratory sample analysis of the waste, telephone Engineering with the sample results for a real-time calculation of the required reagent quantity to neutralize a variable amount of waste water (e.g., 2,000 - 5,000 gallons), and perform the labor involved in the neutralization procedure. This involved manually transferring, by portable pump, the necessary quantity of acid or caustic from storage. After learning the system operations, engineers have taken the initiative to coordinate with the operators and sample laboratory to develop an improved procedure. The laboratory will now provide the sample analysis results in a standardized form. This enables the preparation of a nomograph by Engineering so that the operator, by using two knowns (waste water volume and sample results), can read the required amount of neutralization agent and perform the process without routine involvement of Engineering.

Solid Rocket Booster Recovery Vessel. The ship for Vandenberg Solid Rocket Booster (SRB) retrieval, the "Independence," has been exercised in recovery operations in the Atlantic and is ready for work in the Pacific. This ship was designed for increased productivity by learning from the operations of the two recovery ships for KSC launches. The Independence is able to recover both SRB frustums and all eight parachutes from the two SRBs while working with a leased work boat obtained primarily to tow one of the SRBs back to port. This capability means that the SRB recovery operations will be supported by one full-time ship and one part-time leased boat, compared to two full-time boats for Atlantic recoveries.

Computer Processing Improvements. The contractor that operates KSC's administrative computers implemented a change to the processing procedure for the NASA payroll which resulted in a 40% savings in the run time. The Computer Division also implemented an automated scheduling process for KSC's Space Transportation Accounting and Resources System (STARS) which reduced end-of-month processing from 48 hours to less than 24 hours. This lets all users get on-line one full day earlier after end-of-month processing.

Langley Research Center (LaRC)

Contract Information Management System. A computerized Contract Information Management System has been designed to provide automated processing and status of Coff contracts with major benefits accruing to inspectors, contract specialists, and operating officials. (Developed by the Facilities Engineering Division.)

Lewis Research Center (LeRC)

Strategic Planning. Nothing affects the productivity of an organization as much as the development of a consistent and thoughtful strategic plan. Without it, programs and projects can be developed to the point of fruition, and then scuttled as efforts are redirected to new goals that are equally short lived. To counter this wasteful process, the Center management has worked hard over the past few years to develop and improve its strategic planning process so that it is more effective and reliable as a management tool. In each subsequent year, the emphasis shifts to different aspects of the philosophy and strategy. There is growing interest throughout the Agency to apply similar processes on a broader scale for Agency and Center Planning and development.

Improved Communication. In order to improve the Center's communications system, a new digital phone system was installed to replace a 40-year-old manual switchboard. The new system improves personal productivity by permitting direct calls to individuals, providing a flexible conferencing system and a voice message exchange for recording of messages.

Headquarters

Standard Parts Program (Code D). A NASA Standard Parts Program (NSPP) Lead Center Office has been established at the Goddard Space Flight Center (GSFC) along with provisions for staffing with a senior level electrical, electronic, and electromechanical (EEE) parts management team. This team can draw on the support of the considerable parts engineering skills within the existing civil service and contractor parts groups at GSFC. A major benefit will be a more frequent updating and expansion of the NASA Standard Parts List (NSPL) in close coordination within the Agency, centers, and major contractors, with emphasis on Space Station needs. This will have the direct result of increased standard part usage with an attendant increase in reliability and a decrease in the engineering and testing resources required for non-standard part usage.

Safety Program Goals (Code D). Establishment of quantitative goals for each center has proven to be an excellent management tool for reporting Agency performance, establishing priorities for appropriate areas of emphasis, and performing trend analyses. The Agency performance for FY 85 was outstanding in reflecting a 22% reduction in OWCP accident claims versus Federal OSHA goal of 6%, and a new record low for NASA employee lost time.

Reporting System (Code E). The Division Chief Scientist has instituted a reporting system by which the Principal Investigators are required to submit a 20 - 30 minute video tape presentation describing their research effort. The Microgravity Science and Applications Division program has approximately 50 ongoing research tasks at some 40 institutions. Conservatively, this system saves \$15,000 per year in travel costs, as well as a large amount of manpower time which might otherwise have been spent in transit. It also saves an indeterminate amount of money by ensuring that research efforts are "on track."

Office Automation (Code E). The office automation effort has resulted in significant productivity gains. OSAA now has an internal computer graphics capability, which is used across the organization. Charts are generated in-house, resulting in time and cost savings. Many individuals are using the system for electronic calendaring during the next year.

The capability to analyze program cost data has been significantly improved, and additional benefits are on the horizon. For the past two years, the OSSA budget package was electronically transmitted to the Office of the Comptroller, and the results were very good. This process saved many hours of work over the previous system (which required re-keyboarding of the budget narrative), and increased the quality of the product. Additionally, the implementation of automated systems has greatly increased the ability to respond quickly to the dynamics of the budget. This is especially useful, given the need to react to numerous budget scenarios under short deadlines.

Procurement System Certification (Code H). The Office of Procurement has established a program for assessing and improving the quality of the procurement system throughout the Agency. The Procurement System Certification program provides for a self-assessment against approved system criteria by individual centers. This assessment is

evaluated by the Office of Procurement at Headquarters and through on-site visits at the centers. Strong points and weaknesses in the system are identified and plans are developed to correct any deficiencies.

Improved Public Mail (Code L). In 1985 the first NASA wide Public Mail Coordinators meeting was held in 15 years. Until then, each Center and Headquarters operated their own independent public mail program. So, the same written inquiry mailed to a number of different Centers would very likely receive as many different answers and information materials. Today, communications among the various Public Mail coordinators has greatly increased, new publications are being written and printed to fill their collective needs and--probably more importantly--coordinators are calling each other to suggest new ideas, relay information, share a letter prepared in response to what could be a recurring inquiry, etc. A Public Mail Working Group, named following the March meeting, has also met to determine if assignments to write certain publications have been met and establish a list of new requirements.

Public Mail, while usually unseen, is an important element in NASA's Public Affairs program. For a large number of the general public, a written question or statement is the only contact they will ever have with NASA. The answer they receive, in most cases, is how they perceive the Agency. As a direct result of better communication, in addition to Agency recognition of their efforts and responsibilities, NASA Public Mail coordinators are working to standardize and improve their collective responses to public inquiries. The resulting return is better public appreciation and understanding of NASA goals.

Utility Control System (Code N). The agency-wide Utility Control System (UCS) is a computerized building utility control and monitoring system. This system has the capability to remotely monitor and control building heating, ventilating, air conditioning and electrical systems from a central location.

Since all of the NASA centers encompass large areas and numbers of buildings, it takes a large work force to operate and control the utilities in the various buildings (i.e., start/stop fans, control flows, check temperatures, humidity, pressures, read meters, etc.). When performed manually, problems may go undetected until they become serious and are costly to repair. As an example, when a center-wide electrical outage occurs, it takes many people to bring the center back on-line manually. With the UCS, these types of situations have been prevented or the seriousness lessened with a minimum of one operator at the console, and one or two people available to do the investigation in the buildings.

It is conservatively estimated that the UCS has given the Agency a cost-avoidance of \$1.5 million per year in manpower, utility and repair costs. In addition, the UCS also allows for a more efficient operation of equipment resulting in reduced energy costs.

Facilities Construction (Code N). New methods were used in two facilities construction projects at KSC with resultant savings. A contract construction manager was used to implement the design and construction of the solid rocket booster (SRB) refurbishment facility (a \$25 million project), and the design-build procurement method was used to construct the LC-39 logistics facility (\$20 million project).

For the SRB facility, cost savings of approximately \$500,000 are projected as a result of centralized management of design and construction, and schedule savings of approximately four months are projected by the use of fast-track techniques in the design and construction cycle.

Approximately \$800,000 was saved using the design-build method as compared to the conventional separate and sequential design and construction contracting method. The project construction schedule was reduced approximately two months by overlapping the design and construction phases. The earlier occupancy date resulted in reduced operating costs from having the more efficient operation in place sooner.

Computerized Typesetters (Code N). Code N installed one of the graphics industry's leading computerized typesetters with graphics capability--Modular Composition System (MCS). To operate this new system, on-board personnel had to be trained. With trained personnel to operate the new hi-tech equipment, the Graphics Section is able to produce more in-house end products. During FY 85, an additional work station was added to the Modular Composition System and again an on-board employee was trained to operate the second work station.

Graphics has been able to increase its in-house support service to Headquarters providing improved quality and faster turnaround. Additionally, two employees have increased their productivity.

Team Building (Code S). Beginning with the early days of the Space Station Task Force, Space Station management has stressed the importance of teamwork. In keeping with this practice, Space Station management has conducted a team-building exercise for secretaries to continue to foster this approach. This exercise has acknowledged to the secretaries that they are a vital resource to the OSS and also serves to reinforce previous management efforts. In addition, by continuing to build upon the team approach, the OSS has established a forum for the secretaries to identify key issues and concerns, and to make recommendations to management on how to further increase office productivity.

Standards Review (Code W). In 1984, the Inspector General implemented a Quality Assessment Review (QAR) program to examine how well and to what extent the Office of Inspector General was: (1) fulfilling its responsibilities in conformance with relevant laws, regulations and standards; (2) operating economically and efficiently; and (3) producing effective recommendations to improve agency management. An OIG QAR Guide was designed to provide a standardized framework for evaluating the OIG Center offices individually and collectively. The Assistant Inspectors General have since refined the process, which is now referred to as Standards Reviews.

The Standards Reviews process was effectively implemented and has established the baseline standards for assessing compliance and effectiveness of office operations. An even higher quality of product (i.e., audit and investigative reports), as well as overall office capabilities are the expected results of this innovative process.

3. SUPPORT NEW TECHNOLOGY AND MODERNIZATION IN THE ORGANIZATION

Ames Research Center (ARC)

R&D Planning and Tracking System. The Information Systems Branch was given the assignment of developing a new R&D planning and tracking system. After a few months of investigation, it was decided that it would be difficult to improve on the Langley R&D planning and tracking system. Consequently, in June of 1985 Ames installed the Langley system. Utilization of this system has saved Ames the development cost (\$200,000) and the time (1,000 hours per year) which would have been required for development of a system having equivalent capabilities.

BASIC Programs. A new series of BASIC programs, TRAVEL III, were recently developed in the Financial Management Division to calculate per diem, actual expense, and locality-based flat rate travel vouchers. The programs are being used to compute all travel vouchers that do not involve constructed or foreign travel (approximately 85 percent of all the Center's travel payments). The advantages of using TRAVEL III are many. First, it decreases the possibility of errors. More importantly, it decreases travel voucher preparation time by approximately fifty percent (a 100 percent increase in productivity). In addition, training time is reduced eightfold, and auditing and certification time is reduced fivefold. TRAVEL III is being adopted by other NASA installations including NASA Administration for possible use by other Federal agencies.

Computer Improvements. Within the last year, the Information Systems Branch has developed or installed several new tools for Center-wide use which increase productivity in the accounting and financial management areas. The first tool is an interactive computer program which queries the financial status for all of Ames' activities. The program had been developed primarily for use by accounting and financial management staffs, but was also made available to a broad segment of the Center's technical and administrative management people. The inquiry application makes available Ames financial status data, both in summary and detail forms within seconds or minutes of when the information content is called out. The expected benefits are improved decision-making and responsiveness to management needs resulting from vastly reduced data-collection time. Availability of on-line interactive access is expected to reduce the volume of paper reports and to reduce the workload on the staff currently required to produce and distribute the paper reports. The expected time savings in the first year is 2,000 hours.

Goddard Space Flight Center (GSFC)

Hitchhiker Getaway Special. Individual experiments encased in Getaway Special (GAS) containers are being equipped to access the Space Shuttle's 1400-watt power supply. The GAS containers, called hitchhikers, are mounted to the side of the Orbiter's cargo-bay. Experimenters can now receive in-flight data and send commands to their payloads. The concept reduces the waiting period for flight opportunity, increases the scope of experimentation, and reduces overall mission costs by attracting an expanded field of experimenters who bear some of the mission costs.

Computer-Aided Design. Engineering design computer workstations are now used to develop advanced data handling and processing subsystems for upcoming missions. Interactive graphics capabilities integrated with design parameters allow engineers to develop designs ranging from high level block diagram to low level gates on chips. Designers simulate and verify performance of the system before building any of the components. The workstations are networked to shared storage to allow a team

concentration on the same components. Engineers are designing systems using high performance gate arrays that are extremely space- and power-efficient. For certain telemetry data packet handling functions, these computer-aided designed systems are expected to increase data handling rates by a factor of 100 while reducing costs by a factor of 10.

ISEE-3 Converted to First Comet Explorer. The International Sun Earth Explorer (ISEE-3) was deflected from its halo orbit in order to begin a complicated set of lunar orbits which culminated in its remarkably accurate escape trajectory toward history's first encounter with a comet (giacobini-Zinner). In addition to the knowledge that was gained from the detailed study of a comet at close range, the series of lunar swingbys that ISEE-3 performed before starting its path to the comet involved excursions into the Earth's geomagnetic tail in a region which had never before been explored. ISEE-3, renamed the International Cometary Explorer (ICE), was used to produce a function far beyond its original mission, and obtain in-site data from a comet without the need for the development of a new spacecraft.

Software Development for Production Management. The International Satellite Cloud Climatology Project (ISCCP) can now monitor the processing of monumental volumes of global data, on schedule, by using a unique production management system: the Cloud Image Processing System (CLIPS). Responsibilities include data handling and communication between ISCCP Centers, multi-stage processing of satellite radiance measurements, and development of a global cloud climatology data set. CLIPS allows a minimal workforce to perform the huge data production for the Global Processing Center (GPC).

Video-Teleconferencing. A video-conferencing capability has been created between GSFC in Maryland and the TRW Corporation in California. Send-and-receive facilities installed at each site now communicate via commercial satellite links on projects specific to this center and this contractor (e.g., the Gamma Ray Observatory (GRO) and the Tracking and Data Relay Satellite System (TDRSS)). Travel resources have been used more effectively; decision-making is accelerated; expert input is easily incorporated to fully explore options; teamwork is heightened; communication is facilitated.

Consolidation of Support Services. An employee team, tasked with the responsibility of facilitating office automation support services, recommended combining an administrative correspondence center, microfilm services, information services, and systems support services. A result was the newly formed Office Automation and Technology Support group which now provides one-stop support services efficiently. Consistent workflow practices now help ensure consistent quality.

Jet Propulsion Laboratory (JPL)

Upgrade Lab Equipment. The Electric Power Systems JPL Enhancement Team has developed a computer data base of its equipment inventory to establish current capabilities and show future requirements. Property data are programmed to track current status versus needs. This program has identified obsolete and surplus equipment to eliminate from inventory and storage, thereby resulting in a cost savings. The data base was also used to respond quickly and efficiently for proposals to obtain equipment funds for use in FY 1985. The quality of the justifications enabled the Section to obtain three items of badly needed equipment.

Shuttle Payload Estimation. Through the years of development, two methods for estimating Shuttle payload loads have emerged as the most effective. One method,

referred to as the mass acceleration curve, is a very simple, quick, and reliable method for obtaining preliminary loads for primary structure as well as design loads for secondary structure. Another method for obtaining more refined design loads, the shock spectra/impedance method, has been used as the primary tool in the design of Voyager and Galileo. This method avoids the complexity and expense of the transient system loads analysis which involves many technical and management interfaces.

The mass acceleration curve has been recognized as a cost-effective design tool outside JPL, specifically by the Aerospace Corporation and the European Space Agency (ESA). The Aerospace Corporation is currently funding JPL to extend this concept to a wide class of Shuttle payloads. The mass acceleration curve has also been incorporated into INVIRONET, a design data base for Shuttle experiments.

Productivity improvement in using these two loads prediction methods for Voyager, Ulysses, and Galileo lies in two areas: (1) engineering work hours, and (2) computer resources. While it is difficult to attach a dollar amount to this increase in productivity, a very rough estimate of the cost savings to date would be \$1 to 2M.

ADP Acquisition. The Automated Data Processing (ADP) Management Office has developed a family of planning aids which are used for preparing automated data processing equipment acquisition justification documents. The planning aids are softcopy skeleton outlines posted on the JPL electronic mail system which include the document format, introductory sentences, table formats, fill-in-the-blank sections, notes and, in some cases, boilerplate entries. This simplifies the ADP acquisition plan preparation process and ensures more uniform justifications which reduce the review and approval effort. Office automation and microcomputer users have electronic access to the planning aids which can be downloaded to local workstations for preparation. The result from the use of these softcopy skeleton documents is a reduction of 15 to 25% of the user efforts needed to prepare the plans, and a general improvement of the quality of completed plans being submitted for approval. The improved ADP plan quality has permitted the DP Management Office to handle an estimated 25% increase in workload for FY 1985 without additional staff support.

Memory Test. The Electronic Parts Reliability Section installed a Fairchild 5588 Memory Test System. After one year of operation it has been determined that:

1. The testing throughout is generally greater by a factor of 10 than in previous approaches. For certain engineering evaluations there is improvement by a factor of 100 through use of special functions embedded in the system.
2. Programming time, which is a large proportion of total test time, has been reduced by a factor of two.

Through the combination of improved productivity and capability, this system has been very effectively used to develop approaches applied to resolution of memory problems on Project Galileo.

Tracking Facility. Operation of the former Goddard Space Flight Center's STDN 26-m Tracking Facility (Mojave) at Goldstone was consolidated with the JPL Goldstone Deep Space Communication Complex on October 15, 1984. In this mode of operation, the station has, in 1985, continued to support the ongoing GSFC missions plus the High Earth Orbiting extended missions 160 hours/week with a 33% reduction of staff. This was made possible by consolidating the management, business office, logistics, facilities and some maintenance and implementation support functions with those of the Goldstone DSN Complex. Additionally, the station is being operated with fewer operator-technicians.

Similar or greater productivity improvement has been realized by NASA through the consolidation of the Madrid, Spain and Canberra, Australia 26-m STDN facilities with the Madrid and Canberra Deep Space Communication Complexes. At these two overseas locations, greater productivity is being realized due to the relocation of the facilities with the DSN stations.

Administrative Information Systems. As one step toward improving management productivity through improved administrative information systems, the Institutional Data Systems Section was formed to provide dedicated support of JPL business computer systems. Through the focus on administrative systems, the new section is able to provide the systems engineering necessary to the development of an integrated management.

Johnson Space Center (JSC)

Developing New Engineering Analysis Tools. As an engineering organization carrying out space flight missions at the leading edge of technology, an integral part of JSC's productivity improvement effort is directly associated with the development and/or application of new engineering tools. Major developments include a CAD capability to provide a centralized file for Space Station configuration drawings and support various analytical programs; an engineering data base for Space Station to provide an up-to-date controlled environment of design source data assuring consistency across the work package elements; a new workstation-based STS payload support system to provide more cost-effective support to STS payload customers as well as provide significant operational advantages; and modified SMS (Shuttle Mission Simulator) simulation execution using externally supplied data that provides a framework for managing development of the basic simulation software on a 6-month schedule, as well as savings associated with the simulation load reconfiguration template.

Expanded Office Automation. More than 500 personal computers were added to JSC during FY 1985, and major progress made in the development and implementation of an integrated CIN (Center Information Network) that enhances their usefulness. This extensive office automation effort is supported by a user coordination group made up of key users from each organization that focuses on general problems, provides for transfer of applications between organizations, and facilitates input on additional products and new or emerging technologies to be researched.

The CIN interconnects most of the large mainframe computers at JSC. The majority of the Center's new personal computers have been networked to CIN to provide management and engineering personnel with access to various office automation products, the Center's administrative information system for budget data, and a Centerwide electronic mail system. In addition, linkages through CIN provide both intercenter and intracenter information dissemination functions and also include contractor facilities. These linkages and supporting software products have substantially improved communications by allowing rapid information dissemination. This, in turn, has improved contractor relationships and created a stronger sense of teamwork between JSC and support contractor personnel.

The following examples indicate the breadth and scope of office automation applications at JSC:

1. Use of a Lotus 123 spreadsheet model to perform rapid cost comparisons of Space Station alternative design and systems approaches.

2. A Computer program for analyzing proposals that contains all cost elements, all applicable factors, and proposed objective, and maximum labor rates and indirect rates.
3. A procurement computer network which supports the preparation and processing of procurement documentation, by providing FAR (Federal Acquisition Regulations) clause matrices, coordination and approval matrices, procurement placement code matrices, and other pertinent files.
4. Automation of the analysis of blast and fragmentation hazards which has reduced analyses time from four hours to 20 minutes while allowing a more thorough and reliable analysis to be performed.
5. A computer program to eliminate manual inventories and recordkeeping related to the maintenance, modification and calibration of simulator unique display instruments and controls for flight crew trainers and flight procedures development and verification.
6. Development of computerized systems for the STS Integrated and Operations office to aid in day-to-day management activities, improve communications and allow the monitoring of organizational and flight performance.

Improvement Through Technology Enhancement. The development and use of technology to reduce costs and improve productivity is "business as usual" for high a technology organization like JSC. They include, for example, a nitrogen tetroxide clean-up system that eliminates high iron nitrate problems in storage and/or propulsion system tanks and feedlines; an improved condensation nuclei fire detector that eliminates humidity chamber flooding problems; new initiator resistance measuring equipment to improve standardized testing of NASA standard initiators, and a computerized machining/milling capability to manufacture specialized space articles.

Improved Condensation Nuclei Fire Detector. The improved condensation nuclei fire detector was developed using a microprocessor in lieu of electronic components, simple one watt solenoid valves in lieu of an electrical mechanical selector valve, and highly absorbent silica material to eliminate humidity chamber flooding problems. This new approach also permits development of the system for manned spacecraft use by solving problems associated with zero "g."

Portable Headset Tester. The new portable headset tester was developed to provide the capability to test the various headsets used for flight and training at locations other than the Headset Test Console at JSC. The ability to test suspect headsets for a go/no go indication in the field has resulted in considerable manpower savings and also avoids the need to ship good hardware for reverification testing.

Initiator Resistance Measuring Equipment. The new IRME (Initiator Resistance Measuring Equipment) was designed, built, and distributed to improve standardized testing of bridgewire resistance in NSIs (NASA Standard Initiators, which are pyrotechnic devices used through NASA). The new IRME, a microprocessor-controlled resistance measuring and recording system, has provided significant savings in man-hours required for NSI flight certification and documentation, and reduced downtime associated with recalibration and refurbishment of the test equipment.

Computerized Machining/Milling. The computerized machining/milling capability for manufacturing specialized space articles is a CAD/CAM system that will improve the

interface between the engineering design areas and the technical manufacturing processes, and provide a much more rapid response between design creation and manufacture. Staff hours are saved in the programming cycle that creates machine compatible tape that ultimately machines the designed article. Another benefit will be derived when the system is tied into the Centerwide network that will link all CAD/CAM systems and permit ready exchange of information by transmitting data base information electronically from the engineering functions to the manufacturing area.

Kennedy Space Center (KSC)

Planning Research Corporation (PRC) Automated Operations System. PRC has initiated the design and implementation of an automated operations system for improving the efficiency of its clerical and accounting activities, easing the clerical burden on engineering personnel, and providing the engineering areas with computer support for design activities. The system will tie the scattered PRC areas at KSC to a central computer and allow information and documentation data to be rapidly distributed to and among the various locations. In addition, the system design will provide for interfacing with the computers of KSC's Engineering Development Directorate and, in the future, with KSC's office automation system.

Monitoring System for Payload Clean Room Areas. An Automated Environmental Monitoring System was developed by a team of NASA and McDonnell Douglas Astronautic Company employees to provide KSC with a uniform method to gather cleanliness and environmental data in all of NASA's cargo and clean work areas. The system was made up of temperature sensors, humidity sensors, particle sensors, and Apple Computer, printer, and dual drive disc. A computer program was developed which would allow the computer to gather data from all sensing devices, printing only the out of spec conditions occurring in the clean work area in real time and storing all other data. The disc stores seven days of data from all sensing points; weekly this data is transformed or reduced to quick look graphs to give management an overview to determine trends within the facility environment. The data that is gathered and reduced within the Operation & Checkout facility required approximately eight man-hours per week; under the old system it would require about seven man-days of effort per week.

Lightning Protection by Current Control Techniques. Safety regulations do not allow certain activities to continue during electrical storms if they involve handling explosive materials or devices. The Planning Research Corporation has provided new and innovative concepts at the Kennedy Space Center for area lightning protection which greatly reduce lightning induced effects. By applying these techniques to the fuel storage areas at Launch Complex 39 Pad A, fueling operations were allowed to continue during thunderstorm warning periods. Productivity has increased, schedules have been compressed, and savings of about \$1,000,000 per year are estimated.

Langley Research Center (LaRC)

Software System. A new system for Host-Independent Central Graphics Software has been developed within the Flight Software and Graphics Branch, Analysis and Computation Division. The system provides capability for all researchers to use one standard graphics package and reduce need for multiple-user-developed graphics systems with color hardcopy available in a full range of media presentations.

Aeronautical Research Facility. Langley dedicated a new aeronautical research facility on November 13, 1985, the Aircraft Landing Dynamics Facility, a national resource for tests of aircraft wheels, tires, and landing gear systems. The maximum test speed has been increased to 250 mph.

Crystal Formulation. A new technique using liquid crystal formulation, similar to that used in watch manufacturing, has been employed in flight test to monitor transition of flow from laminar to turbulent over a wing. This major savings in test time and cost was developed by the Supersonic Aerodynamics Branch, Low-Speed Aerodynamics Division.

Lewis Research Center (LeRC)

Computer-Aided Design Work Stations. The engineering support services contractor has installed four stand-alone computer-aided design work stations which use CADAM. Phone line communications with the Center's Amdahl mainframe computers allows the contractor to quickly transfer the design data and information for support of projects and programs. Since there are many users of the MVS throughout the country, the Center can now use the programs directly as supplied by the vendor without converting them for TSS use. Improvements to the CADAM system can thus be implemented more rapidly and at less cost.

The computer-aided manufacturing part of CADAM has been put into use in the Center's fabrication shop. Design information in the computer was transferred through the new centerwide cable network to the fabrication shop's numerically controlled machine tools for the production of model fans.

Transistor Test Laboratory. A unique high-power transistor test laboratory has been assembled at the Center to determine the characteristics of power transistors for aircraft and space applications. It is fully computerized in drive circuitry and data handling so that comprehensive measurements that used to take a week can now be done in less than an hour. During the past year a joint effort between Sandia National Laboratory and NASA was performed to determine effects of gamma irradiation on such transistors. Measurements of characteristics were obtained before and after irradiation over a wide range of radiation levels. By using the automated test lab, six man-years of effort were saved.

Marshall Space Flight Center (MSFC)

Productivity Enhancement Facility. The Productivity Enhancement Facility (PEF), a complex of research cells in which NASA and industry engineers cooperate in developing new materials, equipment, processes, and assembly techniques to enhance NASA's space program, was expanded from 7 cells in 1984 to 16 in 1985. Advanced research is currently being conducted involving large horizontal weld tools, vertical weld tools, robotic welding, waterjet cutting, vacuum plasma coating, spray-on-foam-insulation, reaction injection molding, spray ablator, sealant processing, hydrolaser (automated removal of RB thermal protection system), filament winding, composites, pultrusion, CAD/CAM, kinematic simulation, and data control. Examples of the many major breakthroughs directly attributable to PEF activities are outlined in the following paragraphs.

Modified clamps with contour "feet" have been developed in the Large Horizontal Weld Tool Cell which will replace the expandable mandrels currently in use at the Michoud Assembly Facility. Implementation of this new tooling concept in conjunction with the need to purchase two new tools at a combined cost of \$26 million.

A waterjet cutting system with water pumped at 55,000 psi flowing through a needle-like jet at three times the speed of sound has been developed at the PEF which can cut through materials such as fiberglass, graphite, plastic, and with special modifications,

through advanced composites and metals. The configuration of each cut is controlled by a master template. The waterjet cutting system trims and cuts materials in a fraction of the time other methods require, in addition to eliminating the cost of diamond and carbide bits.

Further progress has been made in 1985 towards full implementation of the Variable Polarity Plasma Arc welding process. This progress includes successfully converting four additional ET assembly fixtures to VPPA, bringing the total to seven, implementation of an improved weld torch and two computer software updates developed at the PEF facility, and installation of a seam tracking unit in the vertical weld tool research cell.

A two gun spray concept has been developed in the Spray-on-Foam Insulation Cell which will save 175 pounds per external tank. Foams are delivered to the robot's spray guns, set 120 degrees apart, as two separate liquids in precise proportions, temperatures, pressures, and flow rates. The bond on the lead and trail sides of the hat and rib sections of the intertank has been significantly improved by spraying foam from lead and trail guns thus justifying the elimination of the BX-250 foam application in the valleys as well as the elimination of isochem adhesive (except in the closeout area).

Intensive test efforts, in the Spray Ablator Cell, verified MSA-2 for application to SRB hardware, replacing both hand bonded cork and MSA-1. Implementation on flight hardware has already begun for SRB segments designated for STS-38.

An automated process has been developed in the Hydrolaser (Automated TPS Removal Facility) Cell to accelerate the refurbishment of the Space Shuttle's Solid Rocket Booster (SRB) hardware and to remove personnel from the hostile environmental of a manual water blasting operation. A milestone in software development was made in September 1985 with the fully automated waterblasting of a flight-configured frustum, utilizing newly completed TPS removal software. A milestone in SRB refurbishment technique was achieved when a filament wound motor casing segment was stripped in the summer of 1985.

Intelligent Terminal System. The initial goal of providing a system of 12 dedicated intelligent terminals and three communication exchanges for communication with MSFC mainframe computers and the CRAY-IS computer system at Lewis Research Center was completed in May 1985. The terminals proved their worth by providing means of ready access to the CRAY-IS system for members of the Systems Analysis Branch Loads Team. The increase in reliability of the DEC PRO-380 microcomputers alone was a source of productivity increase over the previous system.

The baseline system performed as was expected and has provided the benefits of increased access and convenience to the analyst that has reduced loss of the analyst's time and increased the group's overall capabilities and effectiveness. The terminals have also provided increased access to the Systems Dynamics Laboratory's VAX 11/780 computer system as well as offering a very effective computing tool inside the terminals themselves.

Space Science Laboratory Central VAX Computer System. During 1985 the MSFC Space Science Laboratory has brought into operation a general purpose computing and networking system within the laboratory. Not only does the new system provide ADP resources not previously available, it also reflects a new unified approach to managing ADP resources, which support the laboratory's active research programs. The successful installation of the system has also included new communication paths to the Space

Physics Analysis Network (SPAN), the NASA Packet Switch System (NPSS), and the Engineering Analysis System (EADS). SPAN access allows laboratory personnel to collaborate with others in the space science community with a new degree of flexibility and speed. The NPSS further expands our opportunities for working with NASA and non-NASA scientists. The installation of the EADS HYPERbus within the laboratory has also been accomplished and now extends to the scientist's office the super-computer power of the central EADS facility, in addition to all of the other laboratory resources.

Test Operations. New equipment was purchased in 1985 to enhance our test operations in several areas. The second test position in the General Purpose Rocket Furnace (GPRF) test facility was completed in 1985 to permit two furnaces to be tested concurrently, or for development testing on a single module furnace to be accomplished in parallel with furnace operations. Mechanical component and systems testing was upgraded by the acquisition of a new leak detector and improved temperature instrumentation. In the Electrical test Laboratory, a new integrated circuit tester was purchased to replace an old unit that was very unreliable.

Electromagnetic Interface (EMI)/Radio Frequency Interference (RFI). Automation of the system for conducting EMI and RFI tests of flight components and experiments was expanded in 1985. The equipment is self-calibrating which precludes the down-time normally required while test equipment is at the calibration laboratory. The analyzer scans an operator-specified frequency span in a matter of seconds and lists the frequency and amplitude of each signal. This greatly reduces the possibility of missing signals of unknown amplitude and modulation and also results in reduced operating time on flight hardware.

Computer Programs for Systems Dynamics Analysis. Commercial and in-house computer programs have been acquired and evaluated for their potential to streamline analyses required in the Systems Dynamics disciplines. Examples include the following: The TREETOP program was developed to compute the dynamics of tree-topology structures in a semi-automated manner. A translator program was developed to convert formulation-efficient APL (A Program Language) programs to production-efficient FORTRAN language. This allows the engineer/ programmer to develop a program in APL, which greatly reduces time and errors, then to translate it to FORTRAN, which runs two to seven times faster in production.

Hydrolaser (Automated TPS Removal Facility). An automated process has been developed to accelerate the refurbishment of the Space Shuttle's Solid Rocket Boosters hardware and to remove personnel from the hostile environment of a manual water blasting operation. A milestone in software development was made in September 1985 with the fully automated waterblasting of a flight-configured frustum, utilizing newly completed TPS removal software. An SRB refurbishment technique was achieved when a filament wound motor casing segment was stripped in the summer of 1985. Present costs per vehicle will be reduced by \$53K, resulting in a total program cost savings of \$8M.

Management Information System (MIS). During 1985, MIS nodal computer systems were established in 10 additional offices, bringing the total number of offices covered by the system to 13. Also, during 1985, security safeguards were developed and implemented for the MIS network, a Centerwide MIS Help Desk was established and maintained by technical personnel to resolve user-hardware and software problems, MIS training programs were developed and implemented, and a task team was established to provide support for Centerwide MIS application development efforts.

Computer Aided Design (CAD)/Computer Aided Manufacturing (CAM). The MSFC CAD/CAM system was significantly upgraded in 1985. The electronic storage was increased to provide the online storage of design data to structural, thermal, architectural, and robotics was installed or upgraded to meet the CAD requirements of MSFC. The following enhancements to the Interactive Graphics Design System (IGDS) were also completed in 1985: (1) Software upgrades were installed; (2) operating system software was upgraded to latest revision level; (3) design workstations were made available to users; (4) plotting capability was enhanced; (5) and special file and graphic processors were installed. In the Test Laboratory, the percentage of designs accomplished on the IGDS versus manual design increased from approximately 30 percent to 70 percent during 1985.

National Space Technology Laboratories (NSTL)

Facility Service Requests. The FSR tracking system was expanded in 1985 to include the tracking of Minor Maintenance Orders (MMOs) and Minor Service Orders (MSOs). There are about 12,000 MMOs/MSOs generated each year which were "tracked" using a manual system. A report of open MMOs/MSOs was generated each month taking approximately eight to 16 hours to complete. Today, this report is generated within minutes.

Cost Saving Initiatives. During a design review of the A&E drawings for the Test Complex, B-2 Test Position Modifications for Single Engine Testing, two recommendations were made by the FOS contractor for changes resulting in a cost savings. One saving was for valve configuration changes and reducing of associated piping in providing liquid oxygen and liquid hydrogen propellant vessel protection. This involved elimination of two selector diverter valves, two pilot-operated relief valves and associated piping by replacement with pilot-operated relief valves, with dual pilots. Second, a more effective manner in mounting industrial water spray rings for the liquid oxygen and liquid hydrogen Run Tanks was recognized. The design required 15 Industrial Water deluge spray rings to be mounted by the tanks. A less costly, more effective manner of accomplishment, deleting 13 spray rings, was implemented.

Time Saving Initiatives. The method in welding pipe previously required three to four employees in a time-consuming procedure, involving trial and error, to fit pipe properly for welding. The improved method of fit-up alignments through use of chain and clamp fixtures, developed in the oil industry, accomplishes weldment fit-ups that save approximately 85% of the fit-up time previously required.

Automation of Material Requests and Purchase Orders. The contractor's Purchasing department developed an automated record and status-keeping system to document Material Request and Purchase Order information for ease in retrieval of data, which not only aids Purchasing personnel, but provides an up-to-date status to each NSTL agency, through the Datatrieve system. This system is used to provide Work Control with the status of all materials ordered to support work orders, and uses the data keyed in to generate reports to the financial system--which provides reports to Purchasing for evaluation of buys from small businesses.

Innovative Changes to Design Modifications. Several changes in an A&E design for the Test Complex B, B-2 Test Position Modification for Single Engine Testing, were recognized as cost savings or cost avoidance actions by the contractor during review. The changes consisted of: rerouting of piping runs; and elimination of piping runs by use of existing proper configuration valves in lieu of rework of existing valves. The cost savings realized in this action amounted to \$79,000.

Conservation of Resources. The Work Control Center of the contractor began automating the tracking of Facility Service Requests (FSRs), work order, approximately two and one-half years ago. Each year about 2,500 FSRs are processed, and of these, 1,200 are active at any one time. Today, the contractor has an extensive FSR tracking system. It was developed on the DEC VAX 11/780 computer using DEC's Datatrieve language. The complete status and costs on an FSR can be retrieved in less than a minute. The gathering of data on multiple FSRs, customers, facilities and crews can be gathered in a matter of minutes. Procedures are written in Datatrieve so that Management Information Reports (MIRs) can be generated on a repetitive basis.

Headquarters

Computerized Travel Calculation System (Code B). Travel III is a travel voucher calculation system designed for use on the IBM PC/XT/AT or IBM-compatible computers. The system can be used to prepare and process Actual Expense, Lodging Plus, and Designated High Rate Geographical Area travel claims. Use of Travel III decreases the time to prepare and process claims and greatly reduces computation errors. This system was developed by the Ames Research Center, Financial Management Division and has been implemented at each of the NASA installations.

Automation Efforts (Code C). As part of Code C's automation efforts, a goal was set to procure and install throughout the entire Office of Legislative Affairs word processors and personal computers with communications capability. This goal was accomplished in 1985. Virtually everyone in Code C has access to an electronic means of communicating/receiving messages and documents to/from Headquarters, field Centers, and several key congressional committee staff, speeding the flow of information and reducing the retyping. Code C also subscribes to on-line legislative bill tracking and status services which enhances research capability.

General Legal Office Support System (Code G). A systematic plan was developed to bring the NASA Office of General Counsel operating procedures into the Space Age with the use of available computer resources. This system has evolved into what is now known as the NASA General Legal Office Support System (GLOSS) which is now considered to be fully operational. The system provides the equipment and procedures for automated legal research, case management and tracking with a management report generating capability, litigation support, and includes communicating word processors with electronic mail capabilities.

Office Automation (Code L). Two new Pitney Bowes facsimile transmission systems (previously Panafax), has greatly enhanced timely communications - and, thereby, efficiency - with all NASA Centers and our prime contractors in Astronaut Appearances, Exhibits and Graphic arts, specifically. In Astronaut Appearances and the News Room, for example, the system has reduced the time required to transmit important, timely correspondence from Headquarters to the field centers from an average of 4-to-5 days to less than one hour.

Electronic News (Code L). Consistent with our agency-wide effort to revise our traditional methods of distributing news and feature material about NASA to all markets, we installed a Satellite Network for distributing audio and video materials electronically rather than by cassette. As a result, our mail distribution to radio stations has been reduced from 3,000/releases to about 600 and TV from 700 video tapes/releases to 250.

Supporting New Technology (Code N). A computer model was developed that enables each installation to compute for each merit pay employee, the amount of merit increase, general (comparability) increase and individual performance award. The computer model, adapted from one developed by the Office of Personnel Management, allows each Center to further modify it to fit their local operating systems. Having made appropriate modifications, a Center can then program pay and performance rating data for merit pay employees and compute total expected dollar value of all the merit increases. This enables the center to program various rating distributions and anticipate the budgetary impact of the merit increases. This eliminates the need for laborious and time-consuming manual computations and allows for more efficient management decision-making.

NASA Equipment Management System (Code N). The NASA Equipment Management System (NEMS) has been implemented at all but two NASA installations. This is the first standard agency-wide automated, on-line, administrative ADP system.

Computer Generated Graphics (Code R). OAST has implemented a major computer-generated graphics production system capable of producing high-resolution color graphics for OAST presentations. Productivity is achieved through the capability to modify on-line existing charts as required for various presentations. Output capability for 8x10 prints/vugraphs and for 35mm slides has significantly reduced the turnaround time for final graphics production. The result is a capability to produce professional quality presentation charts in less time at a significantly reduced cost.

Contractor Initiative (Code S). The Office of Space Station (OSS) allowed its support contractor to acquire a Xerox 8010 Star system. The acquisition of this equipment was absorbed within the contractor's current general and administrative pool and, therefore, had no monetary impact upon the OSS. Extensive analysis comparing the manual Kroy and computer Xerox system during a two month test period reflected a dollar savings (per graphic) in production costs ranging from \$1.80 to \$47.25 depending on complexity and labor costs. In addition, graphic creation and revision times were reduced by 50 percent.

Office Automation (Code U). An office automation system, NBI System 64, which contains seven word processing stations and 16 ports was installed in the Office of Equal Opportunity Programs. The benefits are increased productivity through increased availability to each staffer.

4. CREATE AN INNOVATIVE AND CHALLENGING ORGANIZATIONAL CLIMATE

Ames Research Center (ARC)

Human Element Workshop. A few years ago, the Agency began conducting the Human Element Workshop for alumni of the Management Education Program. Ames sent managers to the workshop. They consistently gave it high praise and recommended it be brought to Ames. The Human Element is based on the theory that all human problems in organizations are interrelated. The objective of the program is to increase productivity and satisfaction by creating conditions where people increase their insights into themselves and their interactions. Various aspects of organizational life are covered such as communications, conflict resolution, performance appraisal, stress, team building and career planning.

The Center has used the Human Element to work on specific issues. One group to take the Human Element was the Numerical Aerodynamic Simulator Project Office (NAS); the NAS Project has one of the Center's highest priorities. Another successful session was composed of the Center's resources people (representatives from resources management, financial management, procurement, personnel, and the directorate technical assistants). Each session has been considered to be extremely valuable to the participants, and effective in accomplishing the objectives of the program. The value of the Human Element is quickly becoming known at Ames, and several organizations have requested the opportunity to experience the program. Ames views this program as having a very powerful and positive impact on productivity, from an individual as well as organizational viewpoint.

Phased Aircraft Maintenance (PAM). One of the reasons for the success for Ames' Airborne Sciences Program are the innovations used in effecting economy. One such example is the innovation used by an Ames support-service contractor, Northrop Services, Inc. In support of the C-130 aircraft over the past year, Northrop has come up with the idea of a Phased Aircraft Maintenance (PAM) inspection which was required every two years at a cost of over \$600,000 per inspection. The cost to NASA for this Phased Maintenance Program is a one-time cost of \$30,000 for the inspection work package, the cost of one full-time aircraft mechanic to supplement the existing maintenance crew, and an estimated \$10,000 per year in Non-Destructive Inspection costs. The savings over a two-year period is approximately \$470,000, a productivity increase of 360 percent. While these savings are significant at this time, the real savings will be to the NASA Airborne Research Program flown on the C-130 over the next eight to 10 years.

Independent R&D. A small percentage of the funds for each government R&D contract can be used for related, innovative R&D projects called "Independent R&D" (IR&D). In FY 85 DOD and NASA funded almost 3,000 IR&D projects at a cost of over two billion dollars. In order to disseminate this information to DOD and NASA users, NASA established an IR&D effort at each of its field installations to evaluate those IR&D projects which would benefit both agencies.

The effort at Ames is coordinated by an IR&D Officer who has taken on the responsibility for seeing that IR&D reports from 29 aerospace corporations (more than any other NASA field installation) are evaluated. Last year, a total of 93 Ames researchers were used to evaluate 185 IR&D reports, a 37 percent increase over FY 84. In addition, several IR&D contractors came to the Center to present reviews of programs of great interest to the Ames staff. Although the value of this effort cannot be readily

measured, comments from our research staff indicate a high rate of return in enhancing their research programs.

Johnson Space Center (JSC)

Space Station Productivity Initiative. Capitalizing on the unique opportunity that a new program offers to incorporate innovative management approaches, productivity has been highlighted as a basic driver in the development of the nation's Space Station, a major new NASA program for which JSC has lead center responsibility. The concept is being approached from all aspects of the program, ranging from program management and contractor effort to the productivity of man in space.

Major program activity during 1985 included proposal evaluation and contract awards for Space Station definition and preliminary design. The need for innovative concepts to reduce cost and increase productivity was built into planning guidelines by specific clause, stressed throughout the RFP (Request for Proposal), and reflected in the contractors' management plans. Both of JSC's Space Station Phase B contractors have established aggressive productivity/innovation programs expected to result in more effective and efficient ways of doing business in all phases of the program.

Productivity was emphasized in the drafting of program requirements and the evaluation and award process as well. The program was divided into four major work packages, each assigned to a separate NASA center, with two contracts planned for each work package. A single "operation" staffed with personnel from each center drafted program requirements, developed a reference configuration, and prepared a "draft" RFP. A single SEB (Source Evaluation Board) finalized the RFP and evaluated proposals leading to award of the eight separate contracts. This approach provided significant manpower savings over utilizing separate activities for each procurement and essentially eliminated the need for additional coordination and integration manpower to assure required programmatic commonalities among the contracts.

Streamlining Policies and Procedures. The streamlining of policies and procedures continues to enhance productivity at JSC and is an ongoing process in all organizations. For example, during the past year, significant gains have been achieved through a streamlined STS/Payload Integration Process to accommodate more timely and simplified activities associated with preparing the payload and shuttle for launch; the use of commercial rather than government bills of lading; a reduction in personnel competitive levels; a revised astronaut selection process; and the use of paraprofessionals to support crew activity planning and ascent reconfiguration products.

Streamlining of the STS/Payload Integration Process includes reduction in the STS Cargo/Payload analytical integration template; compression and combining of major integration reviews; simplified loads, thermal and avionics analyses; and computer-aided integration.

Bills of Lading. An especially significant productivity gain was achieved through use of commercial bills of lading in lieu of government bills of lading on all freight shipments where total cost per shipment was less than \$100. It is estimated that a cost savings of approximately \$120,000 to \$130,000 per year will be achieved by using this system. In addition, it is estimated it takes half the time to prepare and process the more concise commercial bills as compared to government bills of lading.

Astronaut Selection Process. The astronaut selection process was revised in CY 85 to provide a continuous open announcement with applications evaluated and rated as received. Benefits of this more routine and streamlined process include the establishment of a continuing pool of highly qualified applicants, reduced time for selection, less time required by key management personnel on the selection board, and an improved public image since people may apply at any time.

Crew Activity Planning System (CAPS). Initially, engineers performed crew activity planning at the CAPS terminal. As the process and the STS Program matured, it became more efficient to have paraprofessionals provide the major terminal interface to support the crew activity planning engineers in implementing crew activity plans for Shuttle flights on the CAPS computers. This provides the engineers more time to plan for a rapidly increasing Shuttle flight rate and complex and changing flight manifests. A similar approach is being pursued as reconfiguration products are transitioned from one contractor to another. During April 1985 - September 1985, 32 products were transitioned from engineers to paraprofessionals, reducing the cost of 1,680 staff hours by approximately one-half.

Lewis Research Center (LeRC)

Organizational Streamlining. A significant revision to the organizational structure of the Center was over half completed during the past year by eliminating one level of management. The purpose in doing so was to broaden the first level span of management control. Two benefits are derived from the action: 1) communication channels are shortened to enhance the speed and accuracy of the process, and 2) the employee is encouraged to participate more directly in the management process by assuming greater control and responsibility for his or her contribution to the effort of the organization. This adjustment to the organization structure was made without adverse impact upon incumbent supervisors who assumed new duties and responsibilities.

Marshall Space Flight Center (MSFC)

Shuttle Office Productivity Initiatives. The MSFC Shuttle Office has developed a productivity action thrust that includes a comprehensive plan, a full participation planning group, and regularly scheduled meeting for productivity discussions. The first Shuttle Productivity Quarterly Review, with representatives from NASA Headquarters, MSFC, and the Shuttle prime contractors, met in May 1985 at MSFC. The first Productivity Quarterly at a prime contractor was held in September 1985 at Morton Thiokol in Brigham City, Utah. The second was held in December 1985 at Rocketdyne in Canoga Park, California. All meetings have included open discussions of productivity programs and tours of appropriate facilities.

The Shuttle Productivity Plan was baselined in February 1985 and the first updated version was released July 18, 1985. The plan was developed to identify and describe present/planned productivity efforts and activities. The plan has been distributed to NASA/MSFC managers and Shuttle prime contractors.

The Productivity Planning Group has been meeting regularly for more than a year and in 1985, the Shuttle prime contractors as well as Shuttle Quality and Procurement representatives were added. The representatives meet by telecon to foster productivity initiatives and to disseminate productivity enhancement ideas.

Investment In Excellence. The Investment In Excellence (IIE) videotape series introduced at MSFC last year has been presented to over ten percent of the MSFC employees. One

of the four Directorates at the Center has been covered completely with excellent results. Two other Directorates have been exposed to the program and the first Program Office has been scheduled. Participants report that the program was beneficial and especially helpful in their relationships with their peers. A review of the overall project, which is slated to reach all employees, is scheduled for 1986.

Environmental Differential Pay (EDP) System Simplification. A system was devised and implemented to simplify and streamline an outdated one for the application and approval of EDP at the Neutral Buoyancy Simulator (NBS). A manpower savings of approximately 575 man-hours per year plus intangible reproduction costs are estimated using the new system. The old system used an EDP Authorization Form (MSFC 2864) which was filled out by the hazardous duty worker and then signed by five approvers, all of whom were dependent on the NBS diving log (MSFC 3871), the document of record. The new system combines these forms and is dependent upon two signatures before it goes to the Financial Management Office for payment. The revised system has proven to be simpler and less costly in terms of manpower and reproduction costs, to provide a more consistent and surer verification method of time worked to effect earlier payment of EDP, and to require far less attention by management and the individual performing the hazardous work.

Incentive Contracting. With the exception of Rocketdyne, each of the MSFC Space Shuttle prime contractors is currently performing under a Cost Plus Incentive Fee (CPIF) contract. Cost incentive contracts are specifically formulated to improve contractor motivation and are structured to reward contractors monetarily for high performance. Portions of the flight and hardware elements of the SSME contract are under consideration for conversion to a CPIF contract arrangement in late 1986. Negotiations are underway to convert the ET and SRM future procurements to a Fixed Price Incentive (FPI) contract.

Contractor Initiatives. Boeing Computer Support Services (BCSS) - HCC Contractors, BCSS, Contract NAS8-33999, with subcontract Brown and Associates Management Services, Inc. (BAMSI), and New Technology, Inc. (NTI), Contract NAS8-34230, actively support programs to increase production at HCC. During the year, employees participated in the Cost Improvement, New Technology, and Quality Circles programs. Participants in each program were given special recognition by contractor management in addition to any awards received from the program itself. Letters of appreciation, plaques, trips to Space Transportation System (STS) launches, and award of speciality items were used as motivation and award factors to increase employee awareness and proficiency. An Eagle of the Month program was initiated by BCSS during the year to further encourage employee participation in the productivity programs. Each month candidates are selected from the Cost Improvement and Quality Circle programs based on dollars saved, participation in, and support of these programs. From that group a winner is selected and designated "Eagle of the Month." At the end of the year, an "Eagle of the Year" and runner-up are selected. Winners receive certificates, plaques and awards, and are featured in company newsletters and other publications.

BCSS Quality Circles increased from six to 13 circles during the year. The program was initiated during the year by NTI, with two circles established. Each circle has identified problems which impede production and, through use of predefined criteria, arrives at a proposal for improvement in production which is submitted for management approval. High priority is given to this program by contractor management.

Productivity Incentive. Contract NAS8-38000 with BCSS, to provide Program Support Communications to NASA, commenced on April 1, 1985. BCSS, a division of the Boeing Company, already had employee suggestion programs and cost improvement programs established to provide employees with a method of submitting innovative ideas that can contribute to increased productivity. To make the whole process of submitting suggestions and cost improvements more challenging, a contest (Operation Eagle) was developed by the Boeing Company that focused on employee thoughts as to why individuals are the critical ingredient in productivity improvement and how each employee can become even more productive. All participants received an eagle pin to acknowledge their participation in the contest and the eight division winners won a trip to Washington, D.C to spend two days touring the city.

BAMSI Quality Circles. The BAMSI Project Manager sets quarterly goals for each Appendix in the contract, in conjunction with the respective Appendix Manager. A comparison of periodic accomplishments with the established goals is made weekly in the staff meetings held at the project office. In addition, BAMSI has organized a Quality Circle Pilot Program and BAMSI Corporate Officials provided formal training to the seven pilot members who will serve as Leaders in future Quality Circles. Three additional groups have also been established.

Productivity Improvement Program. Teledyne Brown - Teledyne Brown Engineering Company conducted productivity improvement training sessions for engineers and supervisory personnel. Areas covered to date are the Productivity Improvement Program per se, participative management techniques, and controlling absenteeism.

Quality/Productivity Improvement. Martin Marietta (MMA) - The Tethered Satellite System (TSS) prime contractor, MMA, has made considerable progress towards improving productivity and quality enhancement during 1985. The MMA TSS Project Office has identified approximately \$300K in potential cost reductions and method improvements which the MMA TSS Program Manager is reviewing for implementation. In addition, Spacecraft Systems Division, of which the TSS project is a part, held a two-day off-site meeting dedicated to improving productivity of the white collar workers for that area. The MMA TSS Program Manager attended this meeting, which was the pathfinder for similar management seminars throughout MMA Denver. The MMA TSS Safety Engineer received MMA's Safety Employee of the Month Award for the excellent job he did on the TSS Safety Reviews.

Headquarters

Safety Organization (Code D). The staffing level in the safety organization has been reduced by three people this past fiscal year with no visible impact on services provided. Reprioritizing and realignment of tasks were accomplished so that the office could continue to reflect a high level of productivity and outstanding morale.

Inspector General Thrusts (Code W). During FY 85, the Office of the Inspector General (OIG) completed a number of investigations which resulted in recoveries, cost avoidances, restitutions, settlements, and judgements totaling over \$10 million. These investigations included cases where contractors charged NASA for work performed for other Government agencies, mischarged labor costs from "close to ceiling" fixed price contracts to NASA cost type contracts, substituted inferior products for the quality ordered, or charged unallowable costs to NASA.

The OIG also completed investigations into cases regarding NASA and NASA contractor employees, such as, misuse of government property, theft of government property, and acceptances of gratuities. The investigations served as a basis for the courts or NASA management to take action which resulted in significant cost avoidances or recoveries. Some investigations were conducted jointly with other investigative agencies like the FBI. Investigations involving NASA contractors often involved cooperative efforts by the OIG and the Defense Contract Audit Agency.

The dollar accomplishments of OIG investigations during FY 85 are as follows:

Recoveries	\$ 1,326,792
Costs Avoided	8,697,955
Criminal Fines and Penalties	61,000
Restitutions Ordered	12,296
Settlements and Judgements	73,170
	<u>\$10,171,186</u>

In addition, OIG investigations resulted in the indictment of five people or firms as well as the conviction of 10 individuals or forms for criminal offenses affecting NASA.

Government Quality Conference

October 29, 1985



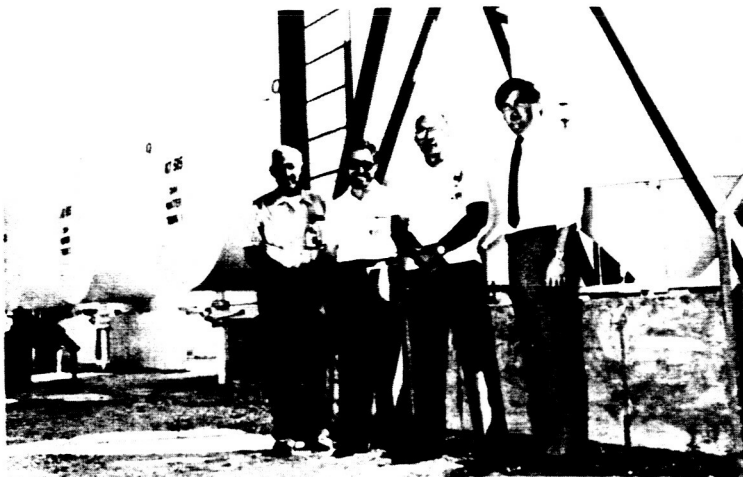


**Productivity Focal Point Meeting NASA Headquarters
August 13-14, 1985**

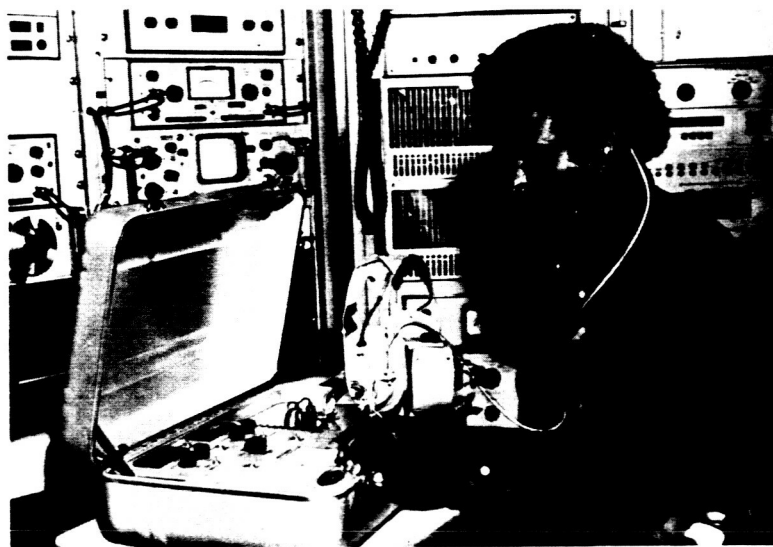


**Planning Session for National Symposium on Quality and
Productivity - Reston, Virginia September 18, 1985**

Equipment Modernization



**Deionized Water Plant at
Kennedy Space Center.**



**Portable Headset Tester at
Johnson Space Center.**



**Advanced Filament Winder at
Marshall Space Flight Center.**

2nd Annual NASA/Contractor Conference

Marshall Space Flight Center

June 12-13, 1985 (Hardware)



2nd Annual NASA/Contractor Conference

Kennedy Space Center

June 19-20, 1985 (Support Services)



Quality Circles



Kennedy Space Center



Johnson Space Center



Jet Propulsion Laboratory



Langley Research Center



Marshall Space Flight Center

5. USE PARTICIPATIVE MANAGEMENT TECHNIQUES TO PROMOTE EMPLOYEE INVOLVEMENT AND CONTRIBUTIONS

Ames Research Center (ARC)

Quality Circle Pilot Study. Ames has been involved with a Quality Circle Pilot Study since October of 1983. Presently, there are 10 circles in operation with three others ready to begin within the next few weeks. The original four circles are still in existence. They represent a diversity of approaches. For example, the Airborne Science Quality Circle, made up of ten civil servants, focuses on aircraft field missions. The Work Environment Quality Circle, made up of four contractors and six Civil Servants, focuses on improving the work environment and promoting productivity. In April of 1985, the Pilot Study initiated circles for the technical side after negotiations with the Union. Circles were formed within the Metal Fabrications Branch, the Plant Engineering Branch, and the Model Technology Branch. Another new circle is comprised of employees from one of Ames' large support-service contractors.

Incentive Awards Program. The Incentive Awards Program at Ames has taken on a significantly larger role in FY 85. The funding level was doubled over the level for FY 84, and the number of cash awards almost doubled, with approximately 20 percent of the staff receiving non-merit cash awards. Along with the increase in the awards budget, the Center Director delegated awards approval authority to division-level management. As a result, the processing time for awards has been reduced.

Publicizing Awards. Increased emphasis has been placed on the publicity of all awards, and each issue of the Ames ASTROGRAM highlights pictures of awards presentations. Managers are encouraged to present awards in informal or formal ceremonies. Many of those ceremonies include the Center Director as the presenter.

Special Awards. This year Ames conducted a special awards program. Over 20 Ames Honor Awards with checks for \$500 were presented to a variety of employees at Ames-Moffett and Ames-Dryden. The awards program was based on peer nomination and in most cases, peer review. Selections were made by the Center Director based on peer committee recommendations.

Employee Suggestion Program (ESP). Because of the recent emphasis on productivity initiatives, Ames completely restructured its ESP in 1985. Ames management made a commitment by appointing an ESP Coordinator. The Coordinator, in turn, formed ESP evaluation committees comprised of five members per committee in each of the seven directorates. The ESP Coordinator receives all the suggestions, and depending on their contents, forwards them on to the appropriate committee. The committee members are responsible for evaluating some of the suggestions. However, if the subject is beyond the expertise of any of the members, then two outside evaluators are selected. For example, the person(s) responsible for implementing the suggestion is usually chosen as an independent evaluator. After receiving all the input, the committee meets to evaluate the suggestion, and if approved, decides the value of the cash award. In FY 85, the ESP committees received 115 suggestions. Of these, 60 were deemed not worthy of an award, 15 received awards, and the remaining 40 are presently being evaluated.

Cash Award. \$3,918 was given to an Ames-Dryden employee for the suggestion of replacing a standard approach lighting configuration comprised of two transition lights and two generators by 116 six-watt fluorescent trouble lights. The adopted suggestion resulted in a one-time savings of \$170,000. The ESP committees feel that the program is a success, and will be expanded through a forthcoming publicity campaign.

Goddard Space Flight Center (GSFC)

Promotion of the Employee Suggestion Program. A 500% increase in the number of submissions and a 2000% increase in monetary awards exemplify the success of increased publicity and promotion of the Employee Suggestion Program. The Program highlights enhancements of all interpretations of productivity. Benefits range from intangible savings (i.e., preventing accidents) to savings quantifiable in both time and dollars.

Johnson Space Center (JSC)

JSC NASA Employee Teams (NETS). In its second year of implementation, the JSC NETS Program reported positive results attained in administrative, professional, engineering/scientific, technician, and secretarial areas. A major new focus was the establishment of integrated contractor/civil service NETS. These teams will use the NETS concept to enhance JSC/contractor and contractor/contractor working relationships.

Kennedy Space Center (KSC)

Employee Teams. The Shuttle Management and Refinement Team (SMART) Program is the Shuttle Processing Contractor's version of quality circles. There have been 30 SMARTs formed involving approximately 300 employees since the program began in September 1984. Although these teams have tackled problems in a variety of categories, the vast number of accomplishments have involved processing efficiencies. In addition to the traditional quality circle concept, SPC has taken a leadership role in the formation of integrated quality circles or KSC Integrated Teams (KITs). A KIT is composed of 8-20 people from two or more organizations who meet to identify and solve organizational interface problems. These KITs have members from KSC contractors and/or NASA. The SPC Team has participated on four KITs to date.

Shuttle Processing Contract Suggestion Program. The SPC Suggestion Program has been processing suggestions since May 1984. As of August 1985, 243 suggestions had been submitted. Of these, 45 had been implemented and 80 are in the process of implementation. Four categories are used in the SPC program: cost savings, safety, intangible improvement, and error cause. To date, over \$112,000 has been saved as a result of all cost-saving suggestions.

Contractor Integrated Suggestion System (CISS). KSC has developed a system that allows suggestions to be transferred between KSC and its contractors. The major KSC contractors have adopted the system in which an employee may make a suggestion to any of the participating contractors or the government. If the suggestion is implemented, the employee receives the award through their own company's suggestion award system. The CISS has been in operation less than a year and a large number of suggestions have been received and resulted in significant improvements and savings.

Langley Research Center (LaRC)

Team Work. The team concept has always been important in the design of aerospace vehicles. An Aerospace Vehicle Interactive Design (AVID) System has been developed with automated transfer of design data providing almost instantaneous feedback. Each member of the team can concentrate on his/her specialty and know results of inputs automatically. Developed by the Space Analysis Branch, Space Systems Division.

Modified Quality Circle. A quality circle modification was installed by the Vehicle Operations Research Branch, Flight Management Division, for a peer review process of technical data within that branch. This resulted in significant strengthening of research conducted because of team involvement.

Employee Subcommittee. The Employee Subcommittee of the Center's overall Equal Opportunity Steering Committee was instrumental in presenting the need for a Day Care Center. As a result, a Center was opened on September 3, 1985, with all available space being filled with eight infants and 30 pre-school children. Parents are predominantly Langley employees.

Quality Advisory Committee. The Space Directorate implemented a variation of the Quality Circle approach by establishing a Quality Advisory Committee with members from each division in the directorate.

Lewis Research Center (LeRC)

Quality Circles. The Quality Circles program continues to expand at the Center with a growth from 16 circles to 36 during the past year. In addition, the training program was extended to include the process of creative decision-making. Additional full-time members of the training and support staff have been selected and are in place. In addition to the resolution of operational problems through the activities of the circles, they are also proving effective in developing problem-solving skills and teamwork. Twenty-six recommendations have been made to management thus far to resolve problems the groups have studied.

Awareness and Alert Program. The Center has placed a high emphasis on the value of team contributions to its goals. Through our Awareness and Alert Program Office, employees are rewarded for their individual contributions to these teams with recognition ceremonies that are held throughout the year. During the past year, 74 such events were held. In addition, special communication programs are designed to help the employees become more fully aware of current issues and to enter into discussions about participative management with our Center Director and senior management. Fourteen such sessions were held with 1,141 employees in attendance, and an additional 37 communication follow-up programs were held at the next lower level of management to address these issues in more detail.

Marshall Space Flight Center (MSFC)

Quality Circles at Boeing Computer Support Services (BCSS). BCSS is convinced that ideas from employees can make a difference in productivity. In that light, BCSS has established their first Quality Circle in the Audio/Visual function and plans to implement the second Quality Circle in the Program Planning and Control Function prior to the end of this calendar year.

Employee Suggestion Program. The MSFC multifaceted Employee Suggestion Program has been improved during the past year with even more improvements in the works for 1986. In 1985, a pamphlet entitled "Suggest" was distributed to all employees. An article appeared in the February issue of the NASA Activities highlighted MSFC's suggestion revitalization effort. The continued success of the program is evidenced by the results. Comparisons of 1985 with 1984 show that the volume of suggestions was up 27 percent (from 174 to 221), the number of suggestions adopted was up 58 percent (from 40 to 63), and the amount of cash awards presented was up 26 percent (from \$15,498 to \$19,538). The average processing time was 61 days. Tangible benefits derived from the

employee suggestion program in 1985 were \$540,154 compared to 1984 benefits of \$917,509 (of which \$584,016 was derived from a contractor's suggestion).

NASA Employee Teams (NET). NET orientations were presented on an organization-by-organization basis from March 1985 through May 1985. As a result of the orientations which were held, 22 new NETS have been set up. Leaders, facilitators and members have been trained in the problem-solving sequence by the Martin Marietta Corporation. There are a total of 31 NETS in operation with well over 300 employees involved. During the pilot program, several teams worked more than one problem and all of the recommended solutions were accepted by their management. Implementation of proposals recommended by the teams resulted in a potential cost avoidance of \$1 million, and \$600,000 in actual cost savings during the one-year pilot. Several of our teams have submitted suggestions through the suggestion award system and have been rewarded for their contribution in savings to the Marshall Space Flight Center.

Incentive Awards. Incentive award funds available for recognizing employee and group accomplishments were increased by 44 percent in 1983, by 20 percent in 1984, by 10 percent in 1985, and are going to be increased by 23 percent for 1986. In 1985, approximately \$502K of incentive award money (including merit pay cash awards) was presented to 1,043 employees for individual or group achievement. In addition, 122 employees were honored with nonmonetary awards. Overall, the Center awards program effectively recognized nearly 35 percent of Center employees for contributions to Center success in 1985.

National Space Technology Laboratories (NSTL)

Employee PIQE and NET/Circle Recognition. NASA, TS contractor and FOS contractor employees were honored with a trip to the 51-D Shuttle Launch at Kennedy Space Center. The honorees were treated to two days of activity preceding the launch which included a tour, videos of previous launches, a reception and an opportunity to meet and talk with members of the astronaut corps. Employee motivation through recognition and involvement in NASA's mission encourages increased efforts.

Employee Teams. NASA/NSTL has formed two Employee Teams, one formed with NASA and the TS contractor employees, and another formed with NASA and the FOS contractor employees. These teams are organized along the typical Quality Circle format, i.e., meeting once a week, with trained leaders and members, assisted by a trained facilitator. The teams were organized in early 1985.

Quality Circle. Quality Circle activities during the year included several projects which improved operations through updating equipment, employing automated systems, improved maintenance practices, and correction of minor safety deficiencies. Some of the accomplishments are outlined below:

1. An FOS Supply Operations Employee Action Circle developed a new automated inventory system to replace the time-consuming and inefficient method of accounting, inventory, maintenance of minimum/maximum levels, and reordering for approximately 6,000 line items stocked in the Site Maintenance Tool Crib. This new method was a result of a brainstorming effort during a circle meeting. The Pan Am Employee Action Circle composed of five members from the Supply Operations Branch designed the new system and forms, and developed procedures for implementing the new practice solely within the resources of the Circle. The new automated system for the Tool Crib will eliminate the frequent physical inventories, researching reorder data, eliminates three reorder documents and eliminates the

research required for determining minimum/maximum levels. The new inventory system is highly efficient and accomplishes daily updating of issue and receipt transactions and has an automatic reordering feature. The system integrity is protected by built-in security levels which protect balances and costs.

2. The integrated circle composed of the FOS contractor's Secretaries for Success Employee Action Circle developed a Secretary's Handbook containing useful information that will ease the learning process for newly assigned secretaries. Additionally, the Handbook will be an aid in providing each secretary with a quick reference guide in accomplishing daily activities.
3. The Heating, Ventilation and Air Conditioning Shop Employee Action Circle of the FOS contractor was experiencing difficulty in accessing building rooftops to service and repair equipment, a difficulty caused by addition of newly installed equipment on buildings with hand ladders, and from newly constructed buildings with inadequate exterior steps. The circle recommendation was for installation of exterior steps to assure a more timely response in equipment maintenance. Action to correct deficiencies within funding availability are being implemented.
4. The Purchasing Department of the FOS contractor developed internal procedures for promoting professionalism by a reduction in the office noise level; controlling visits by unannounced visitors; reducing work interruptions; and expanding/improving the use of the "Dimension" phone system in recognizing incoming calls from Vendors when a Buyer's phone is busy.
5. The Engineering Laboratory of the TS contractor authored a manual for new and long-term personnel. This manual will aid those people who have to deal with internal work systems, such as, TWR procedures, mailing and shipping practices, etc.
6. The System Support group of the TS contractor reorganized the supply room and Tool Crib. The reorganization allows faster access to needed supplies and tools and disposal of obsolete supplies and tools.

Headquarters

Focal Point Meeting (Code A). In August 1985, Productivity Focal Point individuals from each center as well as headquarters met in Washington for a two day planning and strategy session. The Administrator welcomed the group, answered questions and provided the foundation for a successful meeting. Presentations from each of the centers were heard which dealt generally with ongoing center efforts to improve productivity and quality. The group participated in productivity discussions with headquarters officials and heard a report from OMB executives on upcoming government-wide productivity efforts.

Issue Reviews (Code C). A new series of issue reviews was initiated by the Assistant Administrator and chaired by the Deputy to provide a forum for broad internal discussion of NASA-related issues before the Congress. The reviews resulted in improved planning and coordination of strategies among the divisions within the office, and reduced duplication of effort. Sustained participation from the Assistant Administrator and Deputy improved efficiency of staff in the office, and encouraged direct inputs from various levels in the organization.

Participative Management Techniques (Code L). The support staff of the Management Support Division has established and is operating a mechanism for increasing the support

staff's productivity and, therefore, the Division's efficiency. The support staff meets monthly to exchange information and analyze the Division's policies and procedures. In conjunction with this mechanism, a member of the support staff participates in the Division's weekly senior staff meeting to present the support staff's views and to report the meeting's deliberations to the rest of the support staff. That responsibility is rotated through the support staff on a monthly basis.

Secretarial Task Force (Code M). The Code M Secretarial Task Force was established about two years ago. This Task Force has continued to operate, sponsor, and present speakers to address each Shuttle mission and the purpose of a payload being flown aboard each mission. In addition, the Task Force supports the NASA Manned Flight Awareness Program by providing secretarial support for the program at KSC. This activity has provided developmental broadening and awareness opportunities for the secretaries as well as significantly improved communication.

NASA Employee Team (Code M). The Customer Services staff recently created an informal NASA Employee Team (NET) comprised of ten members representing five of the six Customer Services Branches. This team will focus on various division activities and improve communications. Additionally, the Customer Services Division held a two-day retreat resulting in a consensus of fifty-five recommended actions.

Code M placed special emphasis on its monetary award system starting in 1983 through a delegated process. This process allows each Division Director to personally provide more timely acknowledgement of individual employee contributions, and in a collective manner through the Code M Personnel Review Board process, acknowledge major individual contributions to Code M achievements. During FY 85, this resulted in the granting of monetary awards of varying amounts to 46 Code M non-supervisory employees representing a cross-section of skills and pay levels (42% of the staff).

NASA Employee Team (NET) (Code R). OAST has two NETS, the Interoffice NET and the Program Support Specialist NET. As a result of the efforts of the Interoffice NET communications in OAST have been strengthened. The Associate Administrator holds quarterly "All Hands" meetings which are positive in tone and focus on accomplishments, reinforce goals and objectives for OAST employees, recognize employees for their contributions, and provide awards in the appropriate cases. The meetings have promoted an environment of team spirit, increased personnel interactions, and boosted morale.

NASA Employee Team Agency-Wide Meetings. Two agency wide meetings for NASA employee team coordinators were held in 1985. At both the May and December meetings, participants gained an agency perspective on employee participation techniques and practices. This type of gathering is an important mechanism to promote information sharing and address common issues and concerns of the groups.

6. DEVELOP GOOD COMMUNICATION AMONG EMPLOYEES, VENDORS, AND CONTRACTORS

Ames Research Center (ARC)

NASA/Contractor Cooperation. The Ames Research Center purchases most of its electric energy from the Western Area Power Administration (WAPA) and supplemental energy from a local utility. Since the WAPA energy is predominantly hydro-electric, its rate is one-fifth of that from the local utility which relies on fossil-fuel sources. Unfortunately, WAPA has no distribution system extending to its major customers, and is forced to rely on the local utility for transmission. Under the transmission agreement, if the total WAPA system load exceeds a specified limit (brownout), the WAPA customers would have their WAPA allocations replaced by more expensive energy from the local utility by an amount equal to the WAPA system overage. Ames is a unique WAPA customer in that it has a large power demand from its large wind tunnels, and is able to tailor the use of that power demand.

In 1982, Ames anticipated the consequences of a WAPA brownout and approached WAPA with a diversity plan whereby Ames would shut down its wind tunnels on a few selected days when the total WAPA system load approached brownout. In return for the shutdowns, Ames would receive a special rate based on the number of times it saved the system from brownout by shutting down. The present form of the WAPA-Ames contract was the result of two years of negotiations. In FY 85, Ames was able to reduce its electric energy costs by approximately four million dollars in additional energy costs, and WAPA saved seven million dollars in revenues.

Productivity Orientation Seminar (POS). A POS was held on November 18-19, 1985 in Mountain View. The objective of this POS was to supply the working tools to Ames' support-service contractors so that they would be capable of starting their own productivity programs. This POS included site managers of support-service contractors, their technical monitors, contracting officers, and the Ames Focal Point Individual. The agenda for this POS was more in line with the Headquarters-developed POS, retaining the core sessions "productive Organizations and superior Management Practices," "Getting People Involved," and "Managing Change." In addition, Ames productivity participants described their experiences in quality circles, employee suggestion plans, and other productivity initiatives. It was evident at the end of two days that the presented material was only a starter, and that the participants should be given a follow-on seminar in six months to critique and share their experiences.

Goddard Space Flight Center (GSFC)

Gamma Ray Observatory's (GRO) Contractor Productivity Initiative. TRW, the GRO mission contractor, has submitted a productivity improvement event in response to an article of the contract which encourages and rewards productivity initiatives. Called the Integrated Spacecraft Automated Test (ISAT) procedure, the change utilizes advanced database management and software validation techniques for spacecraft assembly and testing. The procedure performs real-time telemetry comparison of the GRO telemetry and the ISATS simulated telemetry, thereby simplifying major tests and reducing the amount of line analysis. The savings in assembly and test schedules as well as test software generation are reflected in the reduction of contract costs by \$234,396.

Merger of Support Contracts. A reorganization combined the Scientific Computing Facility (SCF) and the Vector Processing Facility (VPF) to create the NASA Space and

Earth Sciences Computing Center. Two separate contracts with one company had supported the facilities. One new contract was negotiated to provide combined support. Productivity improved on the contractor side in terms of effectiveness, and on the government side in technical direction and control. Consolidation provided a single point of contact and established a unified set of practices and procedures. Merging the contracts should produce a 10-15% cost efficiency in the first year of the contract alone.

Team Building. Government and contractor personnel who develop and manage the control centers for the Cosmic Background Explorer (COBE) and GRO satellites completed a team building exercise which consisted of two sessions of two days each. Issues of misunderstanding were revealed and addressed. Communications within the joint team have become more open and participants are benefiting from clearer direction, better coordination, and a more productive effort.

Johnson Space Center (JSC)

Consolidating Contractor Efforts and Streamlining JSA/Contractor Relationships. Recognizing the vital role that contractors play in STS operations, JSC has taken a new, innovative approach to streamlining contract management, reducing overhead and consolidating functions by combining work currently accomplished under 41 contracts into two consolidated contracts: STSOC (Space Transportation System Operations Contract) and FEPC (Flight Equipment Processing Contract).

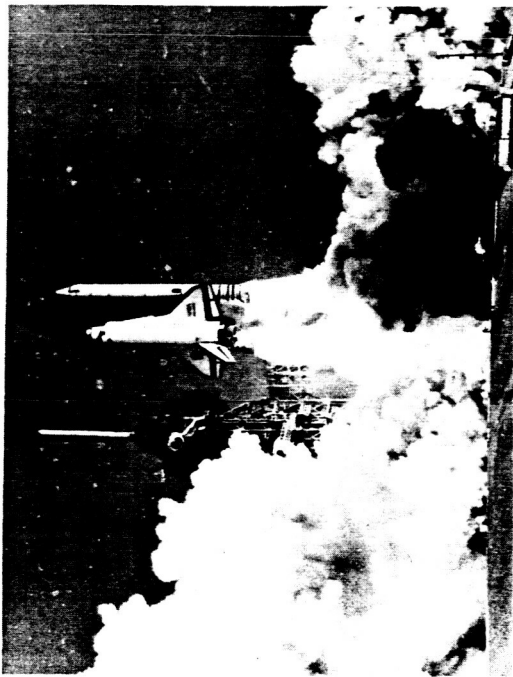
STSOC will consolidate the operations-related efforts of a work force in excess of 3,000 personnel, currently working for 16 contractors under 22 contracts. A single contractor has been selected for negotiations leading to contract award. Substantial savings will be realized through reduced contract overhead and the consolidation of functions to streamline operations support and management and eliminate duplication of functions and services. In addition, productivity improvement is a key criteria in STSOC with an aggressive productivity focus by the contractor and the Government. To stimulate the contractor to achieve further cost savings, a cost saving formula is being incorporated as a clause in the contract.

FEPC will consolidate flight equipment processing work being carried out by approximately 300 employees working under 19 contracts for 16 firms. Consolidation under one contractor and facility will simplify management and operations, eliminate duplication of activities, and provide more timely and efficient resource allocation for supporting the Shuttle mission program. (See diagram next page).

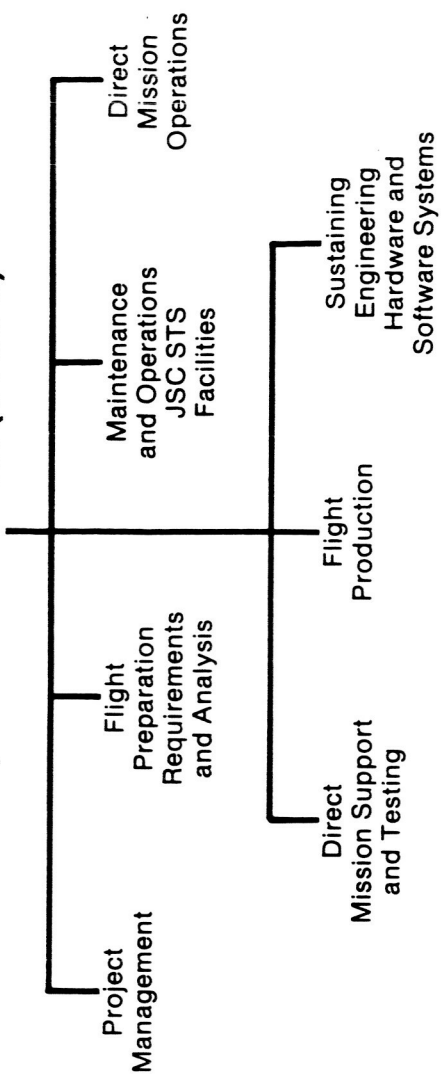
Langley Research Center (LaRC)

Expanded Service. Kelsey-Seybold Clinic expanded its program to include occupationally required physical examinations for Langley contractor personnel at our local Occupational Medical Center. This represents significant costs savings from time lost on the job by going off-site.

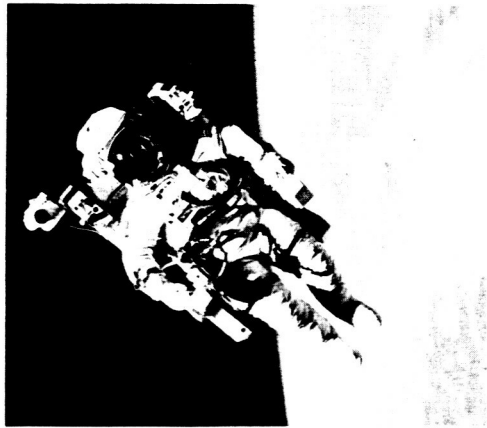
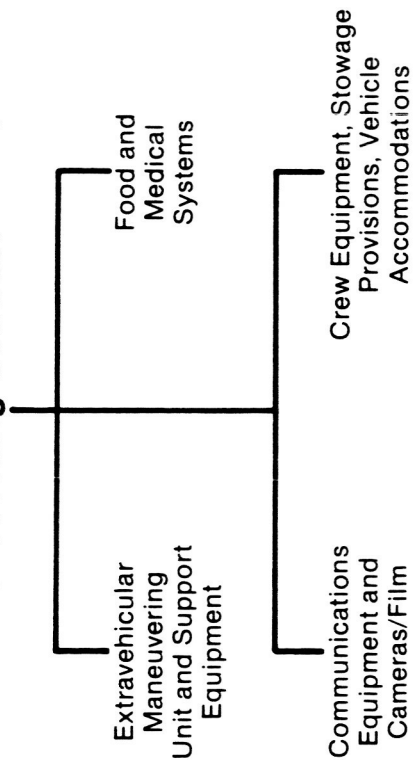
Productivity and Quality Enhancement Seminar. The Center conducted its second Productivity and Quality Enhancement Seminar on September 5-6, 1985 with four teams of supervisors--three from within the Center and one from a support contractor. The Deputy Director welcomed the group and gave an overview. The Center Director concluded with remarks and a question and answer period. Productivity measurement/evaluation is an area emphasized in this program.



Space Transportation System Operations Contract (STSOC)



Flight Equipment Processing Contract (FEPC)



Marshall Space Flight Center (MSFC)

The Marshall Star. The Center's organizational publication, The Marshall Star, is used extensively to publicize the accomplishments of Marshall's PIQE Program. During the past 12 months, stories and a wide range of topics were published. Included were articles on the use of bar codes to enhance productivity, the announcement of the NASA Excellence Award, the successful completion of the pilot NASA Employee Team (NET) program, the accomplishments of eight NETS during the pilot program, the savings that accrued from implementing NET proposals, NASA's recognition of the Center's quality circle efforts, the establishment of ninth NET and, later, a review of its accomplishments. Stories were also published on the selection of NET launch honorees for mission 51-E, the second annual NASA/Hardware Contractors Productivity Conference at Marshall, and cash awards received by two NETS for their suggestions.

National Space Technology Laboratories (NSTL)

PIQE Publicity. Productivity literature has been placed in the NSTL Library for easy access by all personnel. Several journals and magazines are routed, such as the "Training Magazine", the "Quality Circles Digest", "Executive Productivity" and the "National Productivity Review". The availability through publicity provides individuals visiting the library to review the materials and encourages reading, as well as participating and thinking productivity.

Periodically PIQE videos are shown throughout key NSTL locations, and PIQE posters are placed in high visibility display areas. The posters have an "Achievement Theme" and a "Quality Product" design for placement within NSTL work areas. The Achievement theme posters are changed bi-weekly and the Quality posters are changed weekly. PIQE videos shown were: A Passion for Excellence and A Productive Meeting video titled "Meetings, Bloody Meetings".

Monthly articles are placed in the NSTL newspaper denoting PIQE accomplishments and both of the support contractors, Facility Operations and Support Services (FOS) and the Technical Support Services (TS), have internal publications which include PIQE items.

Recognition for Cost Reduction Accomplishments. A revitalized Cost Reduction Program within the FOS contract resulted in cash bonus awards to 14 employees. The cost savings/avoidance actions amounted to approximately \$220,000.

In the new contracts for support services, there are productivity improvement incentive fee articles. The proposals address the innovative techniques and approaches which will enhance the productivity of the proposed contract and discuss how the proposed productivity improvement plans will be evaluated. In order to qualify, the improvement must result substantially from the contractor's own ingenuity and inventiveness, and cannot be an improvement which the government had under consideration or planned to implement at the time of its submission. The contractor will share 40 percent of the actual cost savings resulting from these improvements up to a maximum of 20 percent of the total maximum award fee. The suggestions may be made in such areas as management philosophy, operating procedures and methods.

Headquarters

Congressional Outreach (Code C). In an effort to broaden Congressional support for NASA, Code C is alert to opportunities to involve members personally in aspects of the space program. Additionally, Code C has recently refocused outreach operations, particularly with regard to hosting Congressional Center visits and postflight crew visits to Washington. Outreach efforts have widened the circle and heightened the interest of members and staff, many of whom have traditionally not been included as participants in NASA affairs. For example, close to one-half of the Senate met with the teacher-in-space candidates in one day when they visited Capitol Hill. This is important because a Congressional constituency responds more productively to our issues at critical points if individuals have had previous positive exposure to NASA.

NASA Excellence Award (Code D). The NASA Excellence Award for Quality and Productivity (NEAQP) is in its first year of implementation. This program was recommended by the NASA/Contractor Impediments Study Group as a way to recognize outstanding contractors doing business with NASA. The objectives are (1) to create public awareness of the importance of quality and productivity, (2) to encourage industry to seek excellence in products and services, and (3) to promulgate award winners' methods to others as a form of technology transfer. Approximately 50 hardware companies applied for the award in 1985. Six finalists are currently being reviewed and evaluated and award winners will be announced in January 1986. This program not only aims at productivity improvement and quality enhancement, but should also improve the Nation's international economic competitiveness.

Bidders Mailing List (Code K). A key step for all organizations wishing to do business with NASA is getting on the Bidders Mailing List (i.e., the system that identifies potential sources for all procurements). Each installation maintains its own source system, which through experience has been tailored to the needs of the individual installation and reflects the predominant goods and services that installation buys. Since each Center's system is different, the information required on applications to be added to the Bidders Mailing List also varies from Center to Center.

In view of the different information required, companies seeking to be added to the Bidders Mailing List historically have been advised to apply individually at the NASA Centers at which they hoped to do business. For companies wishing to market to all installations, just this initial procedure required writing ten letters (or making ten phone calls) and receiving ten application packets (many with redundant information) at various times. From NASA's perspective, it required that receiving the letters (or phone calls), delivering the written inquiries to the appropriate office, and assembling and preparing the replies, all be done ten times by ten different individuals to satisfy one company's request.

A simple productivity improvement designed to improve this situation was introduced in the latest revision of Selling to NASA, which is a popular publication that explains procedures for doing business with NASA and is provided to most organizations seeking such information. The booklet now contains a convenient, tear-out request card which enables a company to request application forms for each installation in which it is interested from a single source.

7. STIMULATE INDIVIDUAL TALENT

Ames Research Center (ARC)

Procurement Process. The management for the Procurement Division has long been sensitive to the need for improved productivity in the procurement process both within the division and within the Center. During the last year, the division has been involved in a number of initiatives which have improved the procurement process. The more significant activities are listed below.

Advance Procurement Planning - In the summer of 1984, and again this year, the division solicited early identification of major or critical requirements from the technical organizations prior to the beginning of the fiscal year. This procedure allowed the Contract Specialists to get a better picture of the pending workload at a point early enough to set up effective "work-arounds" as problems occur.

Training - Training is considered a key element in speeding up the procurement process. For example, avoidance of major errors by the Procurement Specialists and/or the technical monitor can save large blocks of time. In February of 1985, several Contract Specialists received training on the changes imposed on the procurement process by Public Law 98-369, the Competition in Contracting Act. By the end of March, the division had presented separate training sessions to each of the procurement branches, the Purchasing Office and to each of the technical directorates. The division also supplied training to technical monitors.

Productivity Initiatives - The division has been actively participating in the Center's productivity initiatives. For example, the division staff has identified what is perceived to be a number of strategies to expedite the procurement process. The division recently sent several people to a productivity seminar, and division managers are scheduled to participate in the next Ames Productivity Orientation Seminar. The division is presently setting up several quality circles.

Automation - The division's internal workload is being tracked on a personal computer, and various reports regarding several aspects of workload are being provided to management on a periodic basis.

These initiatives have paid off as evidenced by the following results. Between 1984 and 1985, the lead time on contracts between \$100K and \$1M has decreased by 19 percent (a 23 percent increase in productivity). In the same period, the lead time on contracts over \$1M has decreased by 25 percent (a 35 percent increase in productivity).

Marshall Space Flight Center (MSFC)

Paperwork Reduction. An extensive paperwork reduction effort was continued in 1985 with a review of all self-imposed paperwork at MSFC initiated in May. It is anticipated that the results of this review will be presented to the MSFC Steering Council at its December meeting. A complete review of established Center forms was conducted in January resulting in a 3.2 percent reduction. Semi-annual reviews of MSFC directives were held to assess current content and continuing need. Seven directives were cancelled and two were combined into one. All reports in the MSFC Reports Management System were revalidated as scheduled and five reports were cancelled.

July, August, and September were the months set aside for the Annual Records Roundup, a special effort to reduce files and improve productivity with an overall goal of 5 percent through destruction or retirement of records. Initial reports indicate a 9 percent reduction.

Three special events were conducted during 1985 to improve productivity. A segment of the MSFC Supervisory Training Course was devoted to paperwork management. A forms improvement training course sponsored by the General Services Administration was attended by the MSFC Forms Officer and Assistant. Also, the Records Management Officer participated in a NASA video conference on Electronic Record Keeping.

Procurement Enhancement. An evaluation of the 40-hour course on procurement management for technical personnel concluded that the real needs of the requiring organizations could be better met by developing and presenting topical seminars which emphasizes "how to" guidance. As a result, a seminar on the requirements of public law 98-72, Small Business Act Amendment, was developed and presented Center-wide. A second seminar on the requirements of public law 98-369, competition in Contracting Act (CICA), was also developed and presented. Future seminars planned include such topics as Developing Evaluation Criteria, Performing Technical Evaluations, and Processing Justifications for Other Than Full and Open Competition.

Initial design, implementation, and verification of the procurement planning module in the Procurement Management Information System (PROMIS) is complete. A presentation was made to the Comptroller's Office on the need to identify procurements at the beginning of the budget cycle. Meetings were held with S&E and the Program/Project Offices for the early identification of planned procurements over \$100K. This data will be a baseline for planning and will comply with CICA requirements.

National Space Technology Laboratories (NSTL)

Productive Use of Manpower. The annual railroad maintenance at NSTL historically required an FOS contractor maintenance shop Supervisor/Superintendent approximately 21 man-weeks of concerted supervision to accomplish each year. In order to relieve management from this requirement and to accomplish the maintenance with the same professional quality, a readjustment in workload was made to utilize the time and talent available in the Environmental Services unit. Pesticide/herbicide work within this unit is principally seasonal, which permitted a Pesticide Technician to attend training in railroad maintenance and qualify to supervise the railroad maintenance function. Now, through proper scheduling, two Pesticide Technicians accomplish the Environmental Services tasks during the peak summer period and the railroad maintenance is scheduled during winter months. The dual qualified technician now performs the supervisory role required in railroad maintenance for approximately 21 weeks each year, with one technician performing the environmental services during this period.

8. GIVE PRIORITY TO EDUCATION AND TRAINING

Ames Research Center (ARC)

Safety Education. Up to 1981 there were seven fatalities and many disabling injuries to workers erecting extremely large facilities at Ames-Moffett. These fatalities occurred despite contractual requirements that heavy construction contractors have comprehensive safety programs in place. As a result of the last fatality, the Center Director mandated the use of a full-time, independent construction safety engineer. After a six months search, Ames hired a civil engineer with 28 years of construction experience plus four years of experience in construction safety.

As a means of heightening the safety awareness of the construction workers and their supervisor, the construction safety engineer kicks off all new construction projects with a safety orientation talk. He attends workmen tool-box safety meetings every week to advise the construction workers as to current safety problems and concerns. In addition, the construction safety engineer makes daily tours of all construction sites looking for hazards and safety violations. The key to safety is the visibility of his inspections.

The productivity payback from the use of the construction safety engineer are: (1) no construction fatality since 1981, and (2) construction lost time injury rates at Ames construction sites are now down to one-sixth of that for the entire construction industry.

Certification. In 1983, an Ames survey showed that less than 10 percent of the Civil Servants and contract personnel engaged in manufacture of electronic equipment have been certified or recertified within the last 10 years. This lack of certification was reflected in a rejection rate of in-house manufactured electronics components in the order of 15 percent.

Because of this situation, Ames has opened a full-time training facility to develop and maintain NASA standards in soldering, wire harness assemble, crimping, wire wrapping, printed wire board repair, and formal coating. This training program has the support of ames management, as evidenced by the issuance of a memo from the Deputy Director to all supervisor which states:

"Workmanship Certification of Proficiency is mandatory for all personnel working on space, aircraft, man-rated hardware, and critical support equipment, and is encouraged for all Ames technicians and inspectors."

The first classes were held in January of 1985 in hand soldering. Over 100 Ames and contractor personnel were certified during FY 85. Feedback from the students has, in general, been enthusiastic. Since their certification, the students are introducing proper tooling and materials into the workplace, and the anticipated benefits in terms of quality and productivity are becoming evident.

Goddard Space Flight Center (GSFC)

Cost-Effective Recruiting. Fifty-one of 106 undergraduate Cooperative Education Program participants have enrolled in our recently instituted Tuition Assistance Program and have signed a service agreement. This approach contributes to the retention of graduates and increases the probability of immediately utilizing the knowledge and experience accumulated by cooperative students when hired full-time after graduation.

Safety Campaign. The Safety Campaign shifted emphasis from citing violations to enhancing personal awareness of possible injury-causing situations. Aggressive publicity activities and positive reinforcement of safe behavior resulted in a decrease of lost workday cases from 21 in FY 84 to eight during FY 85. The reduction of cases represents a savings of 151 man-days.

Information Technology Center. The newly established Information Technology Center (ITC) offers computer and data processing demonstrations as well as personal assistance to patrons who desire the hands-on computerized instruction available through its Learning Center. The ITC greatly expands availability of the self-paced method, and provides a wide variety of learning experiences at many skill levels. The ITC promotes personal and career growth at a low unit cost for instruction.

Jet Propulsion Laboratory (JPL)

Productivity Improvements in the Information Systems Division. The JPL Software Resource Center (SORCE) was created under institutional sponsorship. The Center supports software development and management activities at the Laboratory by providing Institutional Software Standards, training in software management and engineering, tools evaluation, and consultation. In its first year of activity, the SORCE helped four flight and pre-flight projects develop software management plans, taught two courses to 180 engineers and managers, began writing the level 2 supporting documents for the Institutional Software Standards, and consulted with 187 engineers and managers on specific software-related problems and questions. SORCE is providing leadership to improve software productivity at JPL by improving both people and process.

Johnson Space Center (JSC)

Computer Education Center. The Computer Education Center provides computer training for both civil service and contractor employees. During FY 85, 57 courses were offered on a scheduled basis with more than 3,800 employees training in 15,900 hours of effort.

Product Demonstration Facility. The Product Demonstration Facility is equipped with various types of personal computers and printers for use in demonstrating to JSC employees potential applications that might best meet their requirements. Between 75 to 100 persons utilize the facility monthly. In addition, as new equipment comes on the market, vendors are given the opportunity to demonstrate their equipment in this facility. Demonstrations average four a month with attendance ranging from 20 to 100 persons.

Learning Center. The Learning Center for Individualized Training is a self-teaching facility equipped with a bank of resource training materials in portable form, e.g., videotapes, slide cassettes, tape cassettes, etc. Usage of the Center averages between 150 and 200 persons each month. Future plans involve connecting the Learning Center's audio-visual capability to the JSC closed-circuit television network to further augment the learning process.

Secretarial Development Center. The JSC Secretarial Development Center provides a one week program of classroom training for all new secretaries and clerks at the beginning of their employment with JSC. The training includes an overview of JSC and briefings on various specialized aspects of secretarial and clerical work at the center.

Langley Research Center (LaRC)

Secretarial Education. On April 1-3, 1985, the Center conducted a Professional Secretaries Education Program for the first time by bringing together a group of directorate and division-level personnel. Twenty-eight attended a three day workshop at Wallops Island.

Fellowship Program. The Floyd L. Thompson Fellowship Program was modified so that recipients may pursue research studies at an academic institution, at a research laboratory, or at the Center and conduct independent research. Research support up to \$15K is available together with \$2K in travel funds. Competition will be open to all scientists and engineers for one of two winners; the other will come out of performance award mechanisms.

Cash Award. Each year the Center recognizes the best research report by awarding the H. J. E. Reid Award and a cash award. This year, the award was presented to Mr. Patrick Minnis and Mr. Edwin F. Harrison of the Atmospheric Sciences Division. Each received \$1K.

Lewis Research Center (LeRC)

Supervisory Training. A variety of new programs have been developed for supervisory training. They are structured for three different levels of supervisory experience. The "New Supervisory Career Development Program" consists of nine separate courses for new supervisors which provide exposure to concepts of participation. The Series 2 "Careers in Management Program" examines supervisory styles of influence and provides subordinate feedback. The "Leadership Education Program" is the more advanced of the three and combines lectures, survey feedback and discussions with the senior staff.

Nonsupervisory Development. New training programs to develop participative processes have been developed for the nonsupervisory staff so that the appropriate responses occur in a participative environment. The Series 1 "Careers in Management Program" is designed for these people and explores introductory aspects of participation, planning and career development. Another program for senior secretaries titled "Building Excellence Through Secretarial Teamwork" promotes and strengthens the teamwork between secretaries and managers. A retreat process has also been developed for all employees for discussions of issues that concern members of the organizational unit.

Teacher Resource Rooms. The Educational Services Office at the Center has coordinated the establishment of Teacher Resource Rooms at all NASA Centers including the selection and purchase of their equipment, and the selection and reproduction of audio-visual and printed teaching material. In the six state region served by the Lewis Research Center, three additional Regional Teachers Resource Rooms were established at the University of Evansville in Indiana, the Museum of Science and Industry in Chicago and the Science Economic and Technology Center in Milwaukee. Coordination of three additional rooms were provided at the NASA Industrial applications Center of the University of Pittsburgh, at the city college of New York, and at the U.S. Space Foundation in Colorado Springs.

Microgravity Materials Science Laboratory. The Center has opened a new microgravity materials science laboratory to explore the influence of reduced gravity on the production of special purpose materials. This laboratory is used in conjunction with drop towers and high speed "zero-G" aircraft as a precursor to flight experiments on the Space

Shuttle. This complex of facilities is now available to research people from industry and the universities, in addition to the in-house staff as a low-cost and low-risk method to test new ideas for materials science research in space before starting formal development efforts.

Marshall Space Flight Center (MSFC)

NASA Development Programs. The MSFC continues to participate in the various Agency-sponsored executive development programs. Increased emphasis has been placed on submissions of nominees for the University fellowships component which provides for an intense study of management and executive processes. Participants are selected on a very competitive basis for these academically-based programs. Four MSFC nominations were submitted for the 1985 Agency Fellowship Programs; two were selected and a different program was suggested for the third nominee. The Center has one employee attending Simmons College from September 10 - November 15, 1985, and one attending Harvard University Advanced Management Program (AMP) from September 22 - December 19, 1985.

Career Development Program (CDP)/Critical Assignment Development Program (CADP). The MSFC supports and participates in the Agency's developmental work assignment programs such as the CDP and CADP. Since 1975, 26 MSFC employees have completed the CDP. Since 1981, five employees have completed the CADP, and eight have completed the OSF-CADP. There are currently four other MSFC employees at Headquarters under the OSF-CADP.

Newmast Workshop. Starting in August, the second NEWMAST workshop, a NASA-wide program, was held at MSFC with 25 teachers attending. Each of the seven MSFC laboratories conducted one-day programs for the teachers, providing them with the widest maximum exposure to space R&D. The group was also provided daily updates on the science experiments being conducted on Spacelab 2, which was in progress during the workshop. The teachers were enthusiastic about the program and urged that it be continued. Providing a program for updating the science and mathematics backgrounds of the teachers is the goal of NEWMAST.

Teacher Resource Room. New equipment was acquired for the Teachers Resource Room located at the Alabama Space and Rocket Center to improve the flow of information. Video tape recorders were installed so that aerospace information can be copied onto video cassettes provided by teachers. Also, 35mm slide sets have been developed and teachers can have them copied by providing unexposed film. Other new equipment at the resource center includes a filmstrip viewer and a duplicating machine.

Tuition Reimbursement Program at Boeing Computer Support Services (BCSS). Contractor management encourages employee training through a tuition reimbursement program. An average of 30 BCSS employees participated at the undergraduate level and five at the graduate level. NTI participation averaged six undergraduates and three graduates.

National Space Technology Laboratories (NSTL)

Management Development Program. Professional and supervisory training was conducted for personnel in the FOS Contract Management Development Program. Designed to identify and train those individuals who have demonstrated the potential and expressed the interest necessary to become a senior manager or executive, the program strives to

strengthen management skills and aid managers' advancement potential. Employees were selected for the voluntary program based upon their management potential and other criteria. Seminars and training programs presented were:

International Association of Quality Circles. Four FOS contractor employees attended the 1985 International Association of Quality Circles Conference held in Los Angeles, all of whom were involved with the Employee Action Circles. The goal of the conference was to impart knowledge, provide access to products and services, and to permit networking or informal discussion groups among the participants. In addition, as part of the conference activities, each attendee participated in nine presentations which were designed to provide state-of-the-art information on Quality Circles.

Career Seminars. Nineteen FOS contract employees participated in a one-day workshop dealing with the issues of image and self-projection in terms of power and professional effectiveness. The workshop, produced by CareerTrack Seminars, is designed for today's women in business, government and the professions. Directed specifically to the professional woman, "Image and Self-Projection" addressed the special set of image and self-projection problems women face on the job every day. Participants discussed goal setting, managing stress, self-promotion, barriers that hold women back and ways of dealing with and overcoming these barriers. The purpose of the workshop was not only to teach new ideas and skills, but to encourage women in various positions to apply these techniques in the workplace.

Time Management Seminar. Fifty FOS contractor and NASA personnel participated in a "Time Management" seminar conducted by the national CareerTrack training firm. The seminar provided a carefully devised system to help participants achieve specific professional and personal goals and objectives, focusing on the small steps to be taken to enhance and better manage the larger amounts of time in the individual's life.

Headquarters

Teacher Outreach (Code L). During 1985, the number of teachers reached through educational programs was doubled. In part, this was accomplished by improved reporting procedures and communications with the NASA Center educational offices, and in part by several on-Center workshops and conferences directed to specific elements of the educational community. Also, the Office of Management and Budget approved a request to change the Mailing List limit of 55,000 to 100,000 for the quarterly NASA Report to Educators; the increase was granted to provide additional copies for elementary teachers as part of the Operation Liftoff program.

Development Plan (Code M). Since an organizations mission depends on how well it obtains, develops, and utilizes its people, the Office of Space Flight has developed a formal training plan to assure that former OSF secretaries selected and converted to professional administrative positions receive the appropriate training essential for more effective performance of their assigned duties. This plan includes formal course work in such areas as problem-solving, decision-making, negotiating techniques, and basic budget administration. Additional attention is being given to increasing each employee's technical program knowledge and information.

Customer Services Training (Code M). During FY 85, 21 members of the Customer Services staff received training in "Principles of Professional Selling." This course was especially tailored to Shuttle services. The Director, Deputy Director, and all Branch Chiefs have received training. Their response has been enthusiastic, and the results have

been measurable. Follow-on training is scheduled for a mix of Headquarters and field Center staff. Besides providing factual training, these courses serve to develop better communications among the staff and enhance team performance. Code NPD has taken steps to offer this training at the three OSF centers.

Computer Training (Code N). In FY 85, the Headquarters Computer Training Center provided 2,125 instances of microcomputer, word processing and/or software application training. This effort has proven to be the single largest and most intensive training enterprise ever attempted at the Headquarters installation. Employees of every rank, occupational category and organization have been represented in the various training approaches used in the Center, including structured classroom instruction, self-taught/computer-assisted tutorials and individual coaching and consultation.

This effort has clearly facilitated the ongoing surge of office automation occurring at NASA Headquarters and will sustain and enhance this process as a result of FY 86 program expansion and refinement.

9. DEVELOP AND IMPLEMENT MEANS TO EVALUATE TEAM PERFORMANCE

Ames Research Center (ARC)

White Collar Productivity Study. The Technical Information Division (TID) was selected as the Ames Research Center pilot group for a white collar productivity study. Initially, a steering committee was formed and was guided by a representative from the American Productivity Center from Houston, Texas. The steering committee went through the six study phase of: (1) diagnosis, (2) defining objectives, (3) measurements, (4) service design or redesign, (5) team development, and (6) technology. The first task of the committee was to interview all TID employees and a large cross-section of users concerning their basic attitudes towards the division's services. From those interviews, the committee was able to identify the problems, used brainstorming techniques to summarize and choose the best solution, and implemented those solutions. The more important efforts established criteria for measuring specific objectives, initiated workshops to develop trust, team building, and communication skills, and identified and clarified individual roles and responsibilities at points of interface. In addition, requirements for office automation were identified and the equipment purchased. It is the steering committee's perception that the most important result of the pilot study was to have established an experienced nucleus within TID for future problem-solving.

Goddard Space Flight Center (GSFC)

Productivity Measurement System. The processing and execution of work orders in the Plant Operations and Maintenance Division are monitored from receipt to completion. The measurement time-frame is one month. Results are used as a management tool to reveal trouble spots and to justify resource allocations. Posting monthly productivity reports heightens awareness among personnel and demonstrates the division's commitment to improve productivity.

Productivity Improvement Field Pilot. Goddard Space Flight Center (GSFC) participated in a two-year pilot experiment in conjunction with the American Productivity Center (APC), to increase productivity through employee skills improvements, new technology, and improved analysis techniques. The GSFC Comptroller's Office set up teams to work with the APC consultants in such areas as increasing use of technology, involvement with customers, changes in skill mix, position redesign, and continuous measurement techniques. Participants achieved improvements in workflow, communications, attitudes, management style, employee involvement, and an expanded knowledge of customer services.

Johnson Space Center (JSC)

White Collar Productivity Improvement. Increased employee involvement, recommended improvements, and the development of measurement criteria to assess performance were benefits achieved by NASA pilot groups in a two-year White Collar Productivity Improvement project conducted by the American Productivity Center. JSC served as lead center for the NASA effort which included seven pilot groups at five NASA field centers. The two-year project ended in August 1985 with pilot groups continuing to utilize the improvement process on an ongoing basis.

The action research project emphasized productivity improvement through clear definition of services and objectives, employee involvement, and the development of families of measures to assess accomplishment. The effort was focused on functional

groups at the division level with pilot size ranging from 25 employees to more than 100. The seven participating NASA pilot groups included functional areas ranging from engineering and research to procurement and financial management.

Results of the pilot effort have been agency-wide with pilot group measurements being used as a basis for developing additional measurement systems. The effort has provided NASA with first-hand experience in utilizing employee participation as an effective means to improve productivity and develop meaningful measurement systems--systems that not only assess results, but also serve as a basis for planning and implementing continuing improvement.

A final assessment of the project with recommendations on the potential for additional implementation of the process in other NASA organizations will be made by the participating NASA pilot groups early next year.

Lewis Research Center (LeRC)

White Collar Productivity. The Center has completed the start-up phases of two pilot projects directed to white collar worker productivity. One of the projects was performed in the Procurement Division and the other in the Materials Division. The external consultant was the American Productivity Center. The projects completed six phases which consisted of: diagnosis of the current situation, confirmation of objectives, selection of productivity measures, a redesign of services to meet objectives, development of work and planning teams, and the evaluation of technology improvements. The implementation of the study results is in progress and its impact on group performance is being assessed on a continuing basis. The results of these efforts have been of interest throughout the Agency since we are considering the extension of these procedures to other organizational units.

Marshall Space Flight Center (MSFC)

American Productivity Center (APC) Study. The Office of the Associate Director for Management of the Science and Engineering Directorate began a pilot program associated with the American Productivity Center. This pilot group is in the Service (Re)design phase of the six phase program. The pilot, composed of 75 volunteer participants within the parent organization, was established to improve operations and service to the MSFC technical organizations and to improve operations at the interface with other support organizations. The process has already uncovered concerns and areas that require attention. Some of these concerns have already been taken care of through quick fix action. An evaluation of the total process will be made at the conclusion of the pilot period.

Trend Analysis. During the first half of 1984, the MSFC Productivity Steering Council developed a Center-level approach to trend of 16 institutional measures and six project measures covering the following general activities: launch/mission support, R&D programs, NETs, suggestion program, health, safety, procurement, hiring, awards and contractor programs. Data against these 22 indices has been collected for FYs 82, 83, 84 and 85. The set of indices is currently under review by the MSFC Productivity Council for possible revisions and clarifications. The development of effective productivity measures will continue in an iterative process at MSFC.

NASA PRODUCTIVITY PRINCIPALS **Headquarters Officials-in-Charge**

		Code
Administrator	James M. Beggs*	A
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Deputy Administrator	William R. Graham*	AD
• Assoc. Deputy Administrator	Ann P. Bradley*	ADB
General Manager	Philip E. Culbertson*	AS
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Inspector General	Bill D. Colvin	W

NASA Center Directors

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Andrew J. Stofan*	Lewis Research Center
William R. Lucas*	Marshall Space Flight Center
Jerry Hlass*	National Space Technology Laboratories

NASA Productivity Program Office

Director	David R. Braunstein	ADA 453-8431
Asst. Director	Joyce Jarrett	453-8429
• Program Managers	Jeff Forte	453-1925
	Gene Guerny	453-8428
	Ron McCullar	453-2413
	Geoffrey Templeton	453-8435

*Members of NASA Productivity Steering Committee

Administrative Staff	Kim Hudson	453-8766
	Marion Leary	453-8431
	Catherine Smith	453-8766
	Linda Vinson	453-8431

Productivity Focal Points

Lewis Peach	Ames Research Center	464-4124
Charles P. Boyle	Goddard Space Flight Center	344-5121
Fred Felberg	Jet Propulsion Laboratory	792-4241
Wayne Young	Johnson Space Center	525-5421
Warren Camp	Kennedy Space Center	823-2512
Bill Williams	Langley Research Center	928-4700
Milton Beheim	Lewis Research Center	297-2935
William R. Reynolds	Marshall Space Flight Center	872-1932
Herman L. Watts (Acting)	National Space Technology Laboratories	494-1651
Ray S. Mayfield	Headquarters	453-2877

NASA Employee Team Coordinators (NETS)

Dale Crossman	Agency	453-2649
Vicki Gaitanis	Goddard Space Flight Center	344-9465
Leo Lunine	Jet Propulsion Laboratory	961-9086
Alma Martin	Johnson Space Center	525-3152
Gene Bishop	Kennedy Space Center	823-7809
Skip Cole	Langley Research Center	928-3701
Mary Kovach	Lewis Research Center	297-2994
William R. Reynolds	Marshall Space Flight Center	872-1932
Herman L. Watts	National Space Technology Laboratory	494-1651

NASA Employee Suggestion Program (ESP) Coordinators

Dorothy Egbert	Agency-wide	453-2607
Barbara Bush	Ames Research Center	464-5670
Bill Ingerski/Pat Greco	Goddard Space Flight Center	344-8208
Sandra Smith	Johnson Space Flight Center	525-6461
Sandra Malaga	Kennedy Space Center	823-7782
John Cox	Langley Research Center	928-2266
Craig Conlin/Maury Blanton	Lewis Research Center	297-2502
Judy Arnold	Marshall Space Flight Center	872-0902
Herman Watts	National Space Technology Laboratories	494-1651
Barbara Spriggs	Headquarters	453-8510

All telephone numbers are FTS



Productivity Steering Committee meets at Merck, Sharp & Dohme — Oct. 9-10, 1985



Senior Executives Annual Productivity Meeting at Honeywell — Nov. 20-21, 1985